

BOWMAN, ANNE EYRE, M.S. The Relationships Among Dietary Habits, Media Usage, Physical Activity, and BMI in Preschoolers Born to Overweight/Obese Mothers (2010).

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The purpose of this study was to describe the dietary habits, media use, and physical activity of 2 to 5-year-olds born to overweight ( $\text{BMI} \geq 25$ ) mothers. Data were collected on 390 preschoolers enrolled in the KAN-DO study. As part of the study's baseline survey, mothers reported the time her preschooler spent watching TV and using the computer, the frequency with which certain food were eaten, and the average daily duration of outdoor play. Preschoolers were compared based on weight classification.

A larger percent of healthy weight preschoolers ate dessert once per day as compared to overweight and obese preschoolers. A higher percent of obese preschoolers consumed juice  $<1$  time or  $\geq 2$  times per day, in comparison with healthy weight and overweight preschoolers. There were no significant differences between the groups in TV or computer use or in having a TV in the bedroom. However, obese children watched TV while eating dinner more often than healthy weight or overweight preschoolers. Having a TV in the bedroom was associated increased frequency of consumption of soda, sweetened beverages, fast food, fries, and juice. Watching more hours of TV each day was associated with more frequent consumption of soda, sweetened beverages, fries, dessert, and juice. There were no significant relationships between food frequency and computer use. Obese preschoolers participated in significantly more minutes of outdoor play on weekends. Playing outdoors for more minutes on the weekends was significantly associated with decreased consumption of sweetened beverages. Preschoolers engaging

in less than the median minutes of outdoor play on weekdays drank a greater quantity of sweetened beverages. Dessert consumption was negatively associated with preschooler BMI, while mother's BMI and eating dinner while watching TV were positive significant predictors of preschooler BMI.

Results of this study suggest that there is a relationship between increased media use by preschoolers and a higher intake of less healthy foods. Preschoolers with a TV in the bedroom may also be more likely to consume less healthy foods. Not having a TV in the bedroom may be associated with healthier lifestyle choices, such as engaging in more minutes of weekend outdoor play and increased consumption of healthy foods. This research also shows an increased dietary intake while watching TV. In summary, parents should promote healthy behaviors, even in 2 to 5-year-olds, to decrease their preschooler's likelihood of being overweight.

THE RELATIONSHIPS AMONG DIETARY HABITS, MEDIA USAGE,  
PHYSICAL ACTIVITY, AND BMI IN PRESCHOOLERS  
BORN TO OVERWEIGHT/OBESE  
MOTHERS

By

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## APPROVAL PAGE

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## **CHAPTER I**

### **INTRODUCTION**

According to a recent report, the current generation of children in the United States could be the first in more than a century to have a shorter life span than their parents (1). The reason is the alarming increase in rates of childhood obesity. According to results from the 2003-2006 National Health and Nutrition Examination Survey (NHANES), an estimated 31.9% of children and adolescents 2-19 years old are overweight (2). Most alarmingly, among these, 24.4% of preschoolers, ages 2-5, are considered overweight or obese (2). Of these preschoolers, 12.4% are considered obese, up from 5.0% in 1971-1974 (3).

Body mass index (BMI) is the measure most often used to determine overweight and obesity. BMI is a number calculated from a child's weight in relation to his or her height and is expressed as weight/height<sup>2</sup> (kg/m<sup>2</sup>). An expert committee of the American Academy of Pediatrics made the following recommendations in 2007 to classify a child's weight status, based on percentiles for other children of the same age and gender (4): Underweight is defined as having a BMI less than the 5<sup>th</sup> percentile; overweight is defined as a BMI at or above the 85<sup>th</sup> percentile and lower than the 95<sup>th</sup> percentile; and obesity is defined as a BMI at or above the 95<sup>th</sup> percentile. Children of a healthy weight are at or above the 5<sup>th</sup> percentile and lower than the 85<sup>th</sup> percentile.

Childhood obesity is a multifaceted problem. Having a parent who is obese places a child at an increased risk of being obese (5-7). In particular, a mother's obesity at the beginning and at the end of pregnancy predisposes her child to obesity (6). Although the occurrence of obesity has increased for all children over time, there appear to be disparities among racial and ethnic groups. When compared to white children, Hispanic and black children have an increased chance of being obese (5). Socioeconomic status is also a risk factor for obesity, as children born to parents of lower education levels and lower incomes are more likely to be overweight than children born to more well-educated and affluent parents (5, 6, 8, 9).

Several studies suggest that the diets of preschoolers predispose them to obesity. Research suggests that there is a relationship between obesity and the consumption of sweetened beverages, including sodas and fruit juices (10). Skinner et al. found that preschoolers consuming  $\geq 12$  fl oz / day of fruit juice were more likely to be obese than those consuming less (11). Also preschoolers typically do not meet fruit and vegetable recommendations, and they are even less likely to meet the recommendations if they are obese (11-13).

Perhaps just as alarming as the incidence of childhood obesity is that the average American child spends 5.5 hours each day watching TV and videos or using other forms of media, such as video games or the computer (9). Using a nationally representative sample from NHANES 1999-2002, Mendoza et al. reported that preschoolers watching more than 2 hours of TV or videos each day were more likely to be overweight (14). They also found that computer use was associated with adiposity (14).

The effect of television on pediatric obesity is further compounded by influencing the foods children eat. Television advertising can influence the foods that children buy with their own money and also the foods that the family purchases. In 2008, Batada et al. found that 91% of food advertisements on Saturday morning children's television were for foods high in fat, sodium, or added sugars and were low in nutrients (15). Additionally, Brazilian researchers reported that television has a negative impact on the home by causing the consumption of unhealthy foods by the family (16). Television viewing has also been found to impact the foods that children ages 3-8 ask to eat, and the frequency with which the foods were requested paralleled how often they were advertised on TV (17). The researchers found, however, that the children's requests for sports equipment, sports-related items, and physical activities were not correlated with hours of TV viewed (17).

TV viewing by children is increasing. Nielson Media Research reported in September 2006 that children ages 2-11 increased their daily TV use by 4% in 2005-2006 (18). By spending more time watching television and using other types of media, children are spending less time playing and exercising (19). Nearly half of all preschoolers do not engage in sufficient physical activity (20), and thus they do not meet physical activity recommendations. The AAP encourages children to play outside for at least 30 minutes per day, with more specific recommendations varying by age group (21). The National Association of Sports and Physical Education (NASPE) recommends that children play outdoors at least 60 minutes per day (22). Research has suggested that

children not meeting physical activity recommendations are 3 to 4 times more likely to be overweight than those complying with the recommendations (23).

In summary, rates of childhood overweight and obesity continue to increase. The causes of this increase are multi-faceted, being influenced by food consumption patterns, media use, and physical activity level. In preschoolers, an increased consumption of sweetened beverages and fast foods, as well as increased hours of television use, has been associated with overweight,. However, while researchers have suggested that these relationships potentially exist, to date no studies have been reported that investigate the frequency of food consumption, hours of media use, and minutes of physical activity among healthy weight, overweight, and obese preschoolers, and how these factors together might help predict BMI in preschoolers.

## **RESEARCH PURPOSE**

The purpose of this study was to investigate the relationship between hours of media usage, hours of outdoor play, and frequency of intake of high fat (such as French fries, chips, and fast foods) and high sugar foods (such as desserts, sodas, and sweetened beverages) and fruits, vegetables, and milk in preschoolers, ages 2-5, born to overweight and obese ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) mothers and to determine if these factors influence their risk for overweight.

## **SPECIFIC AIMS**

The aims of this study were: 1) to compare frequency of foods consumed, media use, and physical activity in healthy weight, overweight, and obese preschoolers; 2) to determine the relationship between hours of media use and physical activity and the

number of times per day particular foods and food groups are eaten by preschoolers; and 3) to determine whether diet, media use, and outdoor play can predict BMI in preschoolers. While similar assessments have been conducted on preschoolers and in older children, these behaviors have not been studied in a group of this age with mothers who are overweight or obese. Figure 1.1 presents the study model.

Aim 1: To compare food consumption frequency, hours of media use, minutes of outdoor play, and eating while watching TV among preschoolers according to their weight classifications as healthy weight, overweight, or obese.

*Hypothesis 1:* Healthy weight preschoolers will consume more fruits, vegetables, and dairy products, and will consume less sweetened beverages, desserts, and fast foods than overweight and obese preschoolers.

*Hypothesis 2:* Healthy weight preschoolers will spend less time watching TV/videos and using the computer, more time engaged in outdoor play, will be less likely to eat meals and snacks while watching TV, and will be less likely to have a TV in the bedroom than will overweight and obese preschoolers.

Aim 2: To determine the relationship between media use, physical activity, and the frequency of foods eaten by preschoolers.

*Hypothesis 1:* Preschoolers watching more TV and using the computer more will consume fewer fruits, vegetables, and dairy products, and more sweetened beverages, sodas, desserts, and fast foods.

*Hypothesis 2:* Preschoolers engaging in more minutes per day of outdoor play will consume more fruits, vegetables, and dairy products, and fewer sweetened beverages, sodas, desserts, and fast foods.

*Hypothesis 3:* Preschoolers engaging in more minutes per day of outdoor play will spend less time watching TV and using the computer.

Aim 3: To determine whether diet, media use, and outdoor play (physical activity) can predict BMI in preschoolers.

*Hypothesis:* A higher BMI will be associated with decreased consumption of fruits, vegetables, and dairy products; increased consumption of sweetened beverages, desserts, and fast-food meals; increased hours of media usage per day; engaging in fewer minutes of outdoor play each day; having a TV in the bedroom; and eating meals and snacking while watching TV.

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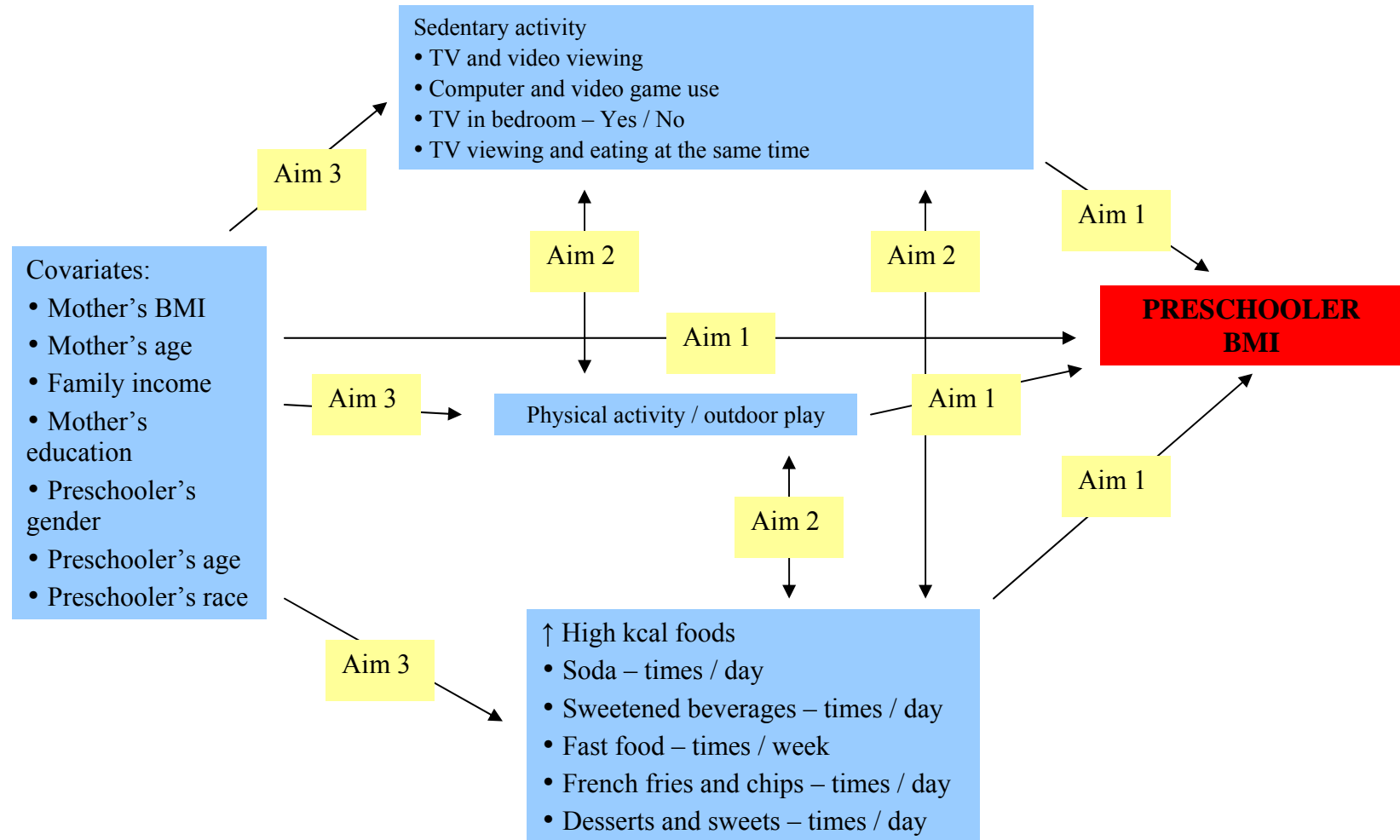


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**Figure 1.1: Study Model**



## **CHAPTER II**

### **REVIEW OF THE LITERATURE**

#### **INTRODUCTION**

The prevalence of overweight preschoolers, ages 2-5, has increased over the last 35 years from 5.0% in 1971-1974 to 24.4% in 2003-2006 (1). Overweight for this age group is defined as having a BMI  $\geq 85^{\text{th}}$  percentile for age and sex on the CDC Growth Charts. Of these 24.4%, 12.4% have a BMI  $\geq 95^{\text{th}}$  percentile, and 8.5% are at or above the 97<sup>th</sup> percentile (2). Studies suggest that this increase in obesity may be due to decreases in physical activity, increases in sedentary activity, and increases in caloric intake (3, 4).

As rates of childhood obesity escalate, so does the prevalence of chronic disease in children. Childhood obesity is associated with Type 2 diabetes, hypertension, liver disease, osteoarthritis, and cardiovascular complications (4, 5). These diseases are primarily associated with adults, but increasing rates of childhood obesity have seen increases in rates of disease in children. Being overweight as a child increases an individual's chances of being overweight as an adult and developing many adult-onset morbidities, such as diabetes, cardiovascular disease, and possibly even cancer (3, 6). Childhood obesity is also associated with increased levels of depression and low self-esteem (7).

Childhood obesity has a multifactor etiology. Having an overweight or obese parent places a child at an increased risk of being overweight himself (8-11). In particular, a mother's weight status predisposes her child to obesity (9, 12, 13). There also appear to be racial and ethnic disparities in the increasing occurrence of childhood obesity. Minority groups, in particular Hispanics and blacks, have an increased chance of being obese when compared to Caucasians (8). Parental education and income also appear to affect weight status: children born to less educated and poorer parents are more likely to be overweight than children born to more well-educated and affluent parents (8, 9, 14, 15).

Studies also suggest that the diets of preschoolers may affect their weight status. Some research indicates that there is a relationship between obesity and the consumption of sweetened beverages, including sodas and fruit juices. Preschoolers also do not usually meet fruit and vegetable recommendations, and this likelihood decreases even more if the preschooler is obese (16-18).

Rates of childhood obesity may also be influenced by increased media use in children. Media includes television, videos, electronic video games, and computers. The average American child spends 5.5 hours each day watching TV or using other forms of media (15). Research indicates that, for preschoolers, watching more than 2 hours of TV/videos each day is associated with being overweight (19). Television viewing has also been found to impact the foods that children ask to eat (20).

Another effect of increased media use is an apparent decline in the time children are spending engaged in active play and exercise (21). Nearly half of all preschoolers do

not engage in sufficient physical activity (22). Research has shown that overweight boys are significantly less active than non-overweight boys (10). The following sections will review the research on potential factors related to childhood obesity.

## **PARENTAL AND SOCIOECONOMIC EFFECTS ON PRESCHOOLER WEIGHT**

Both genetics and environment impact may the development of obesity in preschoolers. Having a parent (8-11), and more markedly a mother (9, 12, 13), who is overweight ( $BMI = 25.0 - 29.9 \text{ kg/m}^2$ ) or obese ( $BMI \geq 30 \text{ kg/m}^2$ ) places a child at an increased risk of being overweight or obese (9, 23-26). Li et al. investigated the additive interactions of maternal pre-pregnancy BMI and breastfeeding on childhood obesity risk. In the group of 2 to 14 year olds, the prevalence of childhood overweight was higher among children whose mothers were overweight or obese before pregnancy than among those whose mothers were of a normal weight ( $BMI < 25.0 \text{ kg/m}^2$ ) (27). Hediger et al. found that the risk of childhood overweight nearly tripled with maternal overweight status and more than doubled if the mother was considered obese (28).

In addition, children of socioeconomically disadvantaged families are more likely to be overweight (8, 14, 15, 29, 30) than those of more affluent families. Whitaker found that among children from low income households, maternal obesity more than doubled the risk of obesity at 2 to 4 years of age (13). Whitaker conducted a retrospective cohort study of 8,494 low income children enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in Ohio. Using WIC height and weight data, the prevalence of childhood obesity was 9.5%, 12.5%, and 14.8% at ages 2,

3, and 4 years, respectively. Of those whose mothers were obese, 30.3% of children were also obese themselves. Additionally, maternal obesity in early pregnancy more than doubled the risk of obesity in the children (13).

Langn se et al. studied 1,350 German children, ages 5 to 7 years, to assess social class differences in weight and other health-related behaviors (31). The prevalence of overweight was 18.5%, with overweight parents being more likely to have overweight children. There was a significant inverse relationship ( $p < 0.01$ ) between overweight and social class, with the heaviest children being in the lowest class. When controlling for parental weight, 37.5% of children of low social class were overweight, compared to 22.9% of children from higher social classes. In a multiple regression analysis, the researchers found that parental BMI and health-related behaviors of children combined to account for 12.5% of the variability in a child's BMI ( $p < 0.0001$ ). However, if neither parent was overweight, SES appeared to have no impact on the child's BMI (31).

On the other hand, recent studies have found an inverse relationship between socioeconomic status (SES) and obesity (30), with levels of parental education seemingly having the greatest influence on this relationship (32, 33). Lamerz et al, in a study of 6-year-olds in Germany, found that indicators of parental education were most strongly associated with children's weight status. The parents of 1,979 children filled out a questionnaire on their child's weight status and on indicators of family socioeconomic status (SES), and from this information, the group also found that children of the lowest SES had three times the risk of being obese when compared to children in the higher social classes (32).

In the United States, minority groups appear to be at an increased risk of obesity. Hispanic and black children have an increased chance of being obese (7, 8, 34-38), when compared with white children. Rates of overweight have been found to be higher in both low-income black (39.5%) and Hispanic (40.2%) children when compared to low-income white (24.0%,  $p < 0.01$ ) children (36). At the same time, Singh et al. reported that, when compared to affluent white children, the odds of obesity were 2.7, 1.9, and 3.2 times higher for poor Hispanic, white, and black children, respectively (8).

### **DIETARY INTAKE OF PRESCHOOLERS**

Increases in energy consumption and decreases in physical activity are assumed to underlie the increased rates of childhood obesity (39). In general, the diets of preschoolers seem to predispose them to obesity. Research suggests that as rates of childhood obesity have increased, so has children's consumption of fast foods and sweetened beverages, including soft drinks and sweetened fruit drinks. In the nearly two decades from 1977 to 1996, the proportion of foods from restaurants and fast food restaurants that children consumed increased nearly 300% (40).

In 2004, Bowman et al. studied 6,212 children and adolescents, ages 4 to 19 years, to examine fast food consumption and its potential link to obesity. On a typical day, fast food was eaten by 30.3% of the sample. Children who ate fast food also consumed more total energy, more total fat, more sweetened beverages, and fewer fruits and non-starchy vegetables. Fast food consumption was not, however, significantly related to BMI (41).



Preschool-aged children eat less than the three recommended servings of vegetables each day, and obese preschool-aged children are even less likely to meet fruit and vegetable recommendations (16-18). In 1999, Skinner et al. interviewed mothers about the dietary intake of their 2 to 5-year-olds. The researchers found that the foods preschoolers most frequently eat are fruit drinks, sweetened beverages, 2% milk, and French fries. Vegetables are the least frequently eaten food group, and when preschoolers are consuming vegetables, they are most likely eating French fries, corn, or green beans (18). Research also suggests a significant association ( $p = 0.02$ ) between sugar intake and BMI (42).

Nelson et al. studied a group of 526 children, ages 2 to 4 years, enrolled in WIC in New York City, NY. The children consumed on average only 2 servings of fruits and vegetables per day, well below the recommended 5 servings per day for this age group. The researchers also found that children who drank more than one serving of non-juice fruit drink per day had increased odds of being overweight (43).

Several other studies suggest a relationship between obesity and the consumption of sweetened beverages, including sodas and fruit juices. In preschoolers, consumption of sweetened beverages increases the odds of becoming overweight among those who are at-risk for overweight and of remaining overweight for those already overweight or obese (44). More specifically, children ages 2 to 5 consuming  $\geq 12$  fl oz / day of fruit juice are more likely to be obese than those consuming less juice (45). Other research indicates that, after controlling for baseline BMI and potential confounders, BMI in preschoolers increases for each serving of sweetened beverages consumed (46, 47). In an analysis of

NHANES data collected from 1988 to 1994, Troiano and Flegal found a positive relationship between soda consumption and overweight in all children, including preschoolers (48).

Welsh et al. studied 10,904 children, ages 2 and 3, with a 1-year follow-up. The researchers found that as the children's daily calorie intake increased, so did their consumption of sweetened beverages. Healthy weight children who consumed 1 or more sweetened drinks daily were 1.3 to 1.5 times as likely to become overweight as children consuming less than 1 sweetened drink per day. Overweight and obese children were significantly more likely to become remain overweight or obese when consuming 1 to more than 3 sweetened beverages daily. When sodas were omitted from the sweet drinks variable, the association between consumption and overweight status remained strongly positive and statistically significant among overweight and obese children. With fruit juice only, however, the researchers found the association with overweight to be positive, but with only borderline significance (44).

## **PRESCHOOLERS AND MEDIA USE**

In the past 20 years, many studies have been devoted to assessing the links between media use (including television, computer, and video games) and food preference with obesity in children. Research suggests that increased television viewing and decreased physical activity are better predictors of BMI in children than diet (49, 50). However, research also indicates that parents are often more concerned with diet and its effects on obesity than a potential link between media use and obesity in preschoolers (51). In general, the literature shows that an increase in the hours of television and

videos watched is related to increased obesity (3). It is estimated that nearly one-third of U.S. preschool children exceed the American Academy of Pediatrics (AAP) recommendation that total media time in children should not exceed two hours per day (52). Children who watch more than two hours of television each day are more likely to be overweight or be at risk for overweight (53). Another study found that children who watched three or more hours of TV per day had significantly higher BMIs than children watching less than 1.75 hours/day (54).

Other studies also support the idea that increased television viewing time may be contributing factor to the increase in rates of preschool overweight. Reilly et al. found that for 3-year-olds, the odds ratio for obesity increased linearly as the number of hours spent watching TV increased. Children who reported watching television 4-8 hours per week had an adjusted odds ratio for obesity at age 7 of 1.37, while those who reported watching more than 8 hours per week had the adjusted odds ratio of 1.55 (26).

In 2009, Greek researchers released the results of the Growth, Exercise, and Nutrition Epidemiological Study in preSchools (GENESIS) study. The study looked at television viewing, food habits, and obesity prevalence in 2,374 Greek children, ages 1 to 5 years (55-57). Parents were asked to report preschoolers' average daily TV hours, on both weekdays and weekends. These numbers were used to calculate the average number of TV hours each day. Parents also completed a structured questionnaire regarding children's physical activity. The mean time spent watching TV by the children was  $1.32 \pm 1.12$  hours per day, with 74% of children watching television for less than 2 hours each day and 26% watching  $\geq 2$  hours/day (55-57). Children's BMI and physical activity level

were significantly associated with the time spent watching TV ( $p < 0.05$ ). Television viewing – daily average, viewing on weekdays, and viewing on weekends – time was shorter among normal weight 1 and 2-year-olds, in comparison to children of the same age who were overweight and obese. Similar results were found in 3 to 5-year-olds in relation to TV viewing on weekends and daily averages (55).

The researchers in the GENESIS study also looked at the influence of preschoolers' television time on obesity prevalence. Obesity was significantly more prevalent among those preschoolers watching  $\geq 2$  hours/day of TV than among those watching  $< 2$  hours/day ( $p = 0.003$ ). Children watching  $\geq 2$  hours/day of TV were 30% more likely to be obese than those watching less. After the children were stratified by age, TV viewing time was significantly associated with the risk of obesity among 3 to 5-year-olds and not among children younger than 3 years. The data however showed no significance after adjusting for total energy intake by the children (57).

Other research suggests that television viewing is associated with increased adiposity in 6 to 7-year-olds, after accounting for factors such as physical activity and diet (49). Jago et al. looked at whether diet, physical activity, and sedentary activity could predict BMI among 3 to 7-year-olds. The researchers followed a group of 3 and 4 year-old children for 3 years, assessing BMI at the beginning and end of each study year. They found that the interactions between both minutes of TV viewing per hour and minutes of physical activity per hour and years enrolled in the study were significant in predicting preschooler BMI ( $p < 0.05$ ). Across the 3 study years, the model accounted for 85% of the variance in BMI. The researchers used mean daily caloric intake and

percent total daily calories from macronutrients as the means of dietary assessment, and diet was not found to be a significant predictor of BMI (49).

Dennison et al. investigated the association between television viewing (including videos) and overweight in a group of multi-ethnic, low-income preschoolers (58). The study included a cross-sectional survey of parents and measurement of children's height and weight for 2,761 preschoolers ages 1 to less than 5 years. Black and Hispanic children had higher mean TV viewing times than did white children, and usage increased with age. Researchers used a multiple logistic regression to determine that the risk of a child having a BMI > 85<sup>th</sup> percentile increased 6% for each additional hour of TV over 2 hours viewed per day. Additionally, almost 40% of children had a television in the bedroom, and these children were more likely to be overweight and spent more time watching TV than children without a TV in the bedroom. Having a television in the bedroom increased the odds ratio of the child having a BMI > 85<sup>th</sup> percentile by 31% (58).

Television may affect the weight status of children by influencing the particular foods that they eat or do not eat. Exposure to food advertisements is related to a significant increase in total food intake in children (59). Excessive TV viewing is associated with higher intakes of energy, fat, snacks, and sodas, as well as with lower intakes of fruits and vegetables. In a study of 5 and 6 year olds, Campbell et al. found that an increased TV viewing time was associated with increased energy intake, increasing sweet snack and high-energy drink consumption, and decreased vegetable intake (60). Food advertising is positively and significantly related to the consumption of

advertised brands of food, which are typically more energy-dense products (61). In a study of 2 year olds, television viewing and computer use was found to be clustered with unhealthy dietary practices, including snacking and drinking sweetened beverages. An alternative “cluster” contained vegetable and fruit consumption, along with whole grain bread consumption and rare white bread intake. The two clusters were inversely related, and children scoring high in the TV and unhealthy dietary practice cluster were more likely to become obese (62).

In the GENESIS study, dietary intake was obtained using weighed food records and 24-hour recalls or food diaries. Daily total energy and macronutrient intake as a percent of total daily calories were calculated, and food group exchanges per 24 hour period were also determined. The total energy intake, along with total fat, monounsaturated fat, and polyunsaturated fat intake, was significantly greater in children watching  $\geq 2$  hours/day of TV each day than in children watching less than 2 hours. Preschoolers watching  $\geq 2$  hours/day also had a higher consumption of exchanges of bread, meat, fat, and other carbohydrates (including sweets and soft drinks). Preschoolers watching more than 2 hours of TV per day ate more fruit and vegetable exchanges than did those watching less TV. Thus watching more TV was found in this group to be associated with increased calorie intake and an increased intake of high fat, high sugar foods (56).

Taras et al. reported that a group of predominantly Hispanic 3 to 5 year olds watched on average 17 hours of TV per week (20). The researchers developed a survey to assess television viewing habits and children’s requests for food. The most commonly

requested foods were high sugar foods, followed by high fat foods, high salt foods, and low sugar/fat/salt foods, in order of decreasing frequency of request.

In another group of 3 to 5-year-olds, the effects of watching TV on children's lunch and snack intake were studied. The children were split into two groups, with one group watching a cartoon and the other group watching no TV. Lunch and snacks were given, with the foods being weighed both before and after eating. Upon enrollment in the study, mothers reported that their preschoolers watched an average of 1.5 hours of TV each day, and they reported that 33% of children ate meals or snacks while watching TV. Overall, fewer snacks and less lunch were eaten while watching the cartoon in the experimental setting, when compared to no TV. However, the children whose mothers had reported they watched more TV at home and who more frequently ate meals in front of the TV at home also ate more lunch in the experimental TV condition. While these results are inconclusive, they do indicate the repeated exposure to television while eating may increase children's intake (63).

Weekly hours of television viewing have been found to be significantly correlated with children's caloric intake and with the specific food requests of children ages 3 to 8, while requests to participate in physical activities or buy sports equipment were not significantly correlated with hours of television (20). Screen time of more than 2 hours per day and active play time of less than 30 minutes per day increased the risk of overweight in the children (20).

Other types of media, such as computer and video games, may influence weight in preschool children. Using data from the 1999-2002 NHANES, Mendoza et al. looked

at TV/video viewing, computer use, and obesity in 1809 children, ages 2 to 5 years. From the survey, 30.8% of children exceeded the AAP guidelines for television viewing. Television/video viewing was more prevalent, with most children using the computer for less than 1 hour a day or not at all. Computer use was associated with being older and coming from a family with a higher income. When looking at combined TV/video/computer use, approximately 36.2% of preschoolers exceeded the AAP recommendation. Researchers used skinfold thickness as a measure of obesity: watching TV for more than 2 hours per day and any computer use was associated with higher skinfold thickness (19).

The literature shows that children who play a moderate amount of video games have a higher weight status than children who play very little or an excessive amount of video games. This holds particularly true for boys (64-66), who typically spend more time playing video games than girls. Children who are older or come from families with higher incomes are more likely to use a computer as well (19, 52).

Vandewater et al. examined the potential links between childhood obesity and television and video game use. Overall, in the group of 1-12 year olds, children who exhibited higher electronic game use were also of a higher weight status. There was a significant curvilinear relationship between video game use and BMI: children with higher weights played moderate amounts of video games, while children with lower weights played either a little or a lot of games. For children ages 1-8, further analyses revealed that girls with higher weight played more video games. The data revealed no relationship between weight status and TV (66).



The effects of increased media use and obesity may also impact the risk for chronic disease, even in preschoolers. Pardee et al. looked at the possible link between daily hours of TV time, obesity, and hypertension risk in children ages 4 to 17. Television time was positively related to the severity of obesity. After controlling for race and BMI, both severity of obesity and daily TV time were significant in independently predicting the presence of hypertension.

Conversely, some studies do not show an association between video game and computer use and obesity. This could be because less time is devoted to playing games and using the computer than watching TV and because video game/computer use is a calorie-free activity due to the use of both hands (67). A study of 7 to 10-year old boys showed that time spent playing video games actually resulted in an increase in metabolism. If the use of video games replaces time spent watching TV, it could positively affect energy expenditure (68).

## **PHYSICAL ACTIVITY IN PRESCHOOLERS**

Television and other types of media influence pediatric obesity in two ways: by decreasing physical activity and by affecting the foods children eat. Media use may replace physical activity, resulting in a reduction in total energy expenditure (69). Higher activity levels are associated with lower BMI, even in preschoolers (25). Nearly half of preschool-aged children do not engage in sufficient physical activity (22). Physical activity recommendations from the AAP vary by age group, but overall children are encouraged to play outside for at least 30 minutes per day (70). The National Association of Sports and Physical Education (NASPE) recommends outdoor play in children for at

least 60 minutes per day (71). Other research suggests that children not meeting physical activity or screen time recommendations set forth by the AAP were 3 to 4 times more likely to be overweight than those complying with the recommendations (65).

Trost et al. (10) studied 3 to 5-year-old children ( $n = 245$ ) enrolled in preschools, comparing the physical activity levels of the overweight and healthy weight children. Physical activity was measured using direct observation with the observation system for recording activity in preschools (OSRAP) and also with accelerometry. The researchers found that overweight boys were significantly less active than non-overweight boys. There were no significant weight-related activity differences in the girls in the study. Overweight children were also significantly more likely to have an overweight parent. This supports the hypothesis that physical inactivity is important in the development of childhood obesity (10).

Taylor et al. studied 244 children, from 3 to 5 years old, longitudinally, seeing the children annually at 3, 4, and 5 years. The researchers were investigating patterns of activity and any changes in activity level that may occur over time. Physical activity was assessed by parent survey and accelerometry data. There were no differences among daily activity levels, nor were children more active on weekends than weekdays. Children spent approximately 90 total minutes each day using an accumulation of TV, video, video games, and computer. An additional 70-90 minutes was spent, on average, involved in other sedentary activities, such as reading, drawing, and playing musical instruments. Physical activity declined significantly from age 3 to age 4, with no further change at age 5. At age 3, physical activity was reported at 81 minutes per day and

decreased to 72 minutes per day at age 4 ( $p = 0.052$ ) and to 57 minutes per day by age 5 ( $p = 0.001$ ). Thus as preschoolers age, their levels of activity appear to be decreasing, and they continue to engage in more sedentary than physical activity (72).

In a study of 467 children, ages 4-6 years, Janz et al. studied the associations among adiposity and physical activity. In the study, adiposity was determined by measuring body composition with dual energy X-ray absorptiometry (DXA). Minutes spent watching TV and participating in vigorous activity were highly associated with increased adiposity. The children in the lowest quartile for exercise had an average body fat that was 4% greater than children in the highest quartile. Children who watched the most TV had body fat percentages that were an average of 3% greater than children watching the least TV (50).

### **COMBINED EFFECTS OF MEDIA USE, PHYSICAL ACTIVITY, AND DIETARY INTAKE**

The research indicates that as media use by preschoolers increases, time spent engaging in physical activity decreases. Nelson et al. found that, on average, children participating in WIC spent more than twice as much time watching television and using computers as they did engaging in physical activity (43). A study of 3 and 5-year-olds in Glasgow, Scotland, UK, found that the median time spent in sedentary behavior at age 3 was 79% of monitored hours and 76% at age 5. Median time spent engaging in moderate to vigorous physical activity was only 2% of hours at age 3 and 4% of hours at age 5, indicating a highly sedentary lifestyle in these children (73).

Other studies have shown less of an association between obesity and dietary intake and more of an influence by energy expenditure in preschool children. In a study of 77 children ages 1.5 to 4.5 years (74), a 4-day weighed food record was used to determine energy intake, and percentage body fat and total energy expenditure were also determined. Energy intake and body composition were analyzed to evaluate whether diet composition was related to body fat in the preschoolers. Researchers found that percent body fat was not significantly correlated with total energy intake or percent of calories from fat, carbohydrates, or protein (74). However, physical activity level was related to body fat.

The GENESIS study also looked at the interaction between TV viewing and physical activity. In the children, physical activity was found to be inversely associated with obesity ( $p = 0.014$ ), and TV viewing time remained significantly related to obesity, even after controlling for physical activity ( $p = 0.048$ ). However, the association between TV and obesity was no longer statistically significant when the researchers controlled for total energy intake ( $p = 0.115$ ). No significant interaction was found among total energy intake, physical activity, TV viewing time, and the probability of being obese. However, after a stratification of the variables, physical activity was significantly related to the probability of being obese ( $p = 0.028$  for children consuming less than the median total energy intake, and  $p = 0.047$  for children consuming more than the median energy intake). This research indicates that the effect of TV viewing time on obesity in children is independent of physical activity. However, increases in obesity may be attributed to increased energy intake during TV watching (57).

Anderson et al. looked at levels of active play, levels of screen time, and weight status in 4 to 11-year-olds, using data from the 2001-2004 NHANES. Researchers found that, among 4 and 5-year-olds, obese children were more likely to watch TV for more than 2 hours per day and participate in less active play, and the obese children were more likely to have both behaviors concurrently. For boys, 17.0% (95% CI, 11.3% - 22.7%) of non-obese boys had levels of both low active play and high screen time, while 30.3% (95% CI, 14.6% - 46.1%) of obese boys exhibited both behaviors. In girls, 19.3% (95% CI, 14.7% - 23.8%) of non-obese children had levels of both low active play and high screen time, while 21.2% (95% CI, 6.8% - 35.6%) of obese girls exhibited both behaviors. This difference in girls was significant ( $p < 0.05$ ).

## **CONCLUSION**

In summary, the prevalence of preschool overweight has increased at alarming rates over the past 30 years. Preschoolers are exceeding the AAP recommendations for media use. Television viewing is associated with higher consumption levels of high-energy snacks and sweetened beverages and decreased consumption of fruits and vegetables (60). As media use increases, it may replace physical activity, decreasing energy expenditure (69).

To date, there are no reported studies investigating the association among food frequency, physical activity, and media use, in preschoolers born to overweight and obese women. Therefore, the purpose of this study is to describe dietary habits, media use, and physical activity in preschoolers born to overweight and obese mothers and determine if these factors influence their risk for overweight or obesity. The frequency of food

consumption, hours of media use, and minutes of outdoor play among healthy weight, overweight, and obese preschoolers will be compared, and then it will be determined if these factors can be used to predict BMI in preschoolers.

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**CHAPTER III**  
**THE RELATIONSHIPS AMONG DIETARY HABITS, MEDIA USAGE,**  
**PHYSICAL ACTIVITY, AND BMI IN PRESCHOOLERS BORN TO**  
**OVERWEIGHT/OBESE MOTHERS**

**INTRODUCTION**

The prevalence of childhood overweight has increased worldwide, including rates of overweight among 2 to 5-year-olds (1, 2). Nearly one-fourth of preschoolers are overweight (2). Research indicates that, in children, the prevalence of overweight will double by 2030 (3) if measures are not taken to reverse this increase. As rates of childhood overweight and obesity increase, so does the incidence of chronic disease in children, and this also increases their risk for obesity later in life (4-7). These effects can result in increased medical costs and may have psychosocial consequences (3).

Due to the life-long implications and effects of childhood obesity, it is important to determine possible causes of these increases. Childhood obesity is a complex problem, with many underlying origins. Having an overweight or obese parent, especially an overweight mother, predisposes a child to obesity (8-11). There seem to be racial and ethnic disparities in the occurrence of childhood obesity as well: minority groups have an increased chance of being obese when compared to Caucasians (8). Parental education and income may also affect child weight status (8, 9, 12, 13).

Increased energy intake and decreased physical activity seem to underlie the increased rates of childhood obesity (14). Consumption of fast foods and sweetened beverages including soft drinks and sweetened fruit drinks, has increased (15, 16). Several studies indicate a positive association between preschooler obesity and the consumption of sweetened beverages (23-27). Preschoolers are also not meeting daily fruit and vegetable recommendations (17-20).

Media use, including television/video viewing and playing video games/computers, may affect pediatric obesity by decreasing physical activity and influencing the foods children eat (21-24). TV viewing time is associated with increased high-energy food and drink consumption and decreased vegetable intake (23, 25-29). Television viewing may also lead to an overall increase in energy intake (30). Research also indicates that computer and video game use may be associated with higher levels of adiposity (31-34).

Media use may also influence childhood obesity by decreasing physical activity, resulting in a reduction in total energy expenditure (35, 36). Nearly one-third of preschool-aged children exceed the American Academy of Pediatrics (AAP) recommendation that total media use by children should be less than two hours per day (37). Children who exceed this recommendation are more likely to be overweight or be at risk for overweight (38). Also, the National Association of Sports and Physical Education (NASPE) recommends outdoor play in children for at least 60 minutes per day (39). Nearly half of preschool-aged children do not engage in sufficient physical activity

(40). Increased physical activity is associated with lower body mass index (BMI) and decreased adiposity, even in preschoolers (10, 21, 33, 41).

To date, there is no published research on the associations between food frequency, media use, physical activity, and BMI in preschoolers born to overweight women. Thus the purpose of this study was to investigate the relationship between hours of media usage (television/videos and computer), hours of outdoor play, and frequency of intake of high fat (such as French fries, chips, and fast foods) and high sugar foods (such as desserts, sodas, and sweetened beverages) and fruits, vegetables, and milk in preschoolers, ages 2-5, born to overweight and obese ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) mothers and to determine if these factors influence their risk for overweight. The aims of this study were: 1) to compare food frequency, media use, and physical activity among healthy weight, overweight, and obese preschoolers; 2) to determine the relationship between hours of media use and physical activity with the number of times per day particular foods and food groups are eaten by preschoolers; and 3) to determine whether diet, media use, and outdoor play predict BMI in preschoolers.

## **METHODS**

### ***Participants***

Participants were 2 to 5-year-olds, who were part of the mother-preschooler dyads enrolled in the “Kids and Adults Now – Defeat Obesity” (KAN-DO) study. KAN-DO is a 2-year study designed to evaluate the efficacy of a family-based intervention, designed to encourage postpartum mothers and their preschoolers to work together to promote a healthy family and to reduce the likelihood of obesity in preschoolers who are



at risk for obesity because their mothers are overweight. Healthy eating, increased physical activity, and decreased sedentary behaviors are all encouraged in KAN-DO.

The preschoolers were the children of overweight and obese women ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ). In order for the mothers to be eligible for KAN-DO, mothers were at least 18 years old, English-speaking, and had an infant less than 6 months old in the home. Mothers must also have had a  $\text{BMI} \geq 25 \text{ kg/m}^2$  before becoming pregnant with their infants and also at the time of entry in the study. Both mother and preschooler had no contraindications to exercise.

The KAN-DO study was dual-site, with participants enrolled in both the Triad area (University of North Carolina - Greensboro) and the Triangle area (Duke University) of North Carolina. A total of 400 mother-preschooler dyads were enrolled in the study. Upon enrollment in the study, families were randomized to one of two groups. Each group received a mailing for their first eight months in the study. Families in the control arm received a monthly newsletter that focused on building preschool reading skills and reading with children. The intervention arm received a monthly family kit that focused on interactive mother/child experiences to promote healthy lifestyle change, through addressing parenting skills, healthy eating, and physical activity. Mothers in the intervention arm also received monthly counseling calls and attended one group class during the eight month intervention period. The aims of the study were to address weight and behavior change in the preschooler, with additionally expected healthy changes in the mother.

Participants were recruited through publicly displayed flyers and through recruitment postcards and phone calls to women who had recently applied for birth certificates within the Triangle and Triad areas. After screening by research assistants (Appendix A) to assess eligibility, consent forms (Appendices B and C) and baseline surveys were mailed to potential study participants, and the women were scheduled for baseline visits. At the baseline visits, consent was received for both mother and preschooler after reviewing the consent form with research personnel. Baseline measurements were completed before the mother became 7 months postpartum. This research was approved by the Institutional Review Boards of both UNCG and Duke University.

### ***Data Collection***

Data were collected from the baseline survey of KAN-DO. The baseline surveys were completed by the mothers upon entry in the study. Survey questions covered a variety of topics, including family eating habits and eating styles, mother's attitudes towards weight and eating, physical activity and television use, and home environment. Media questions estimated the number of hours per day the preschoolers spent in front of the TV and hours spent using the computer. A food frequency questionnaire for the preschoolers was also part of the baseline survey, asking the number of times per day and the amount each time that particular foods were consumed. Physical activity questions asked mothers to estimate the minutes spent playing outdoors during weekdays and weekends. The variables used in this study are listed and described in Table 3.1. Demographic information, such as education and household income, was

obtained from the baseline survey questions, while other items, such as race and ethnicity, were obtained at screening. After completion, baseline survey answers were entered into the KAN-DO database for analysis using CS-Pro.

### ***Anthropometrics***

Anthropometric measurements were made at the baseline visit. Preschoolers and mothers were weighed and measured without shoes and wearing light clothing. Height was measured with a Seca Stadiometer (Columbia, MD) or an AccuStat Genetech Stadiometer (San Francisco, CA). Weight was measured with a Tanita Digital Scale BWB-800 (Arlington Heights, IL).

### ***BMI calculations***

BMI (calculated as weight in kilograms divided by height in meters squared) and BMI z-scores based on the CDC growth charts was calculated for each child using Epi Info, version 3.3 (CDC, Atlanta, GA). The z-scores were used to classify the preschoolers' weights according to BMI percentile: underweight:  $z < 0$ ; healthy weight:  $0 < z < 1.036$ ; overweight:  $1.036 \leq z < 1.645$ ; and obese:  $z \geq 1.645$ . The term overweight describes children who measure higher than the age and gender-specific BMI percentile greater than or equal to the 85<sup>th</sup> percentile and lower than the 95<sup>th</sup> percentile, and obese describes children who surpass the 95<sup>th</sup> percentile. Due to low numbers, preschoolers who had BMIs less than or equal to the 5<sup>th</sup> percentile were excluded from analysis.

### ***Food choices and eating environment***

Preschooler dietary intake was determined with a food frequency questionnaire (FFQ). The FFQ determined servings per day of foods and food groups. The foods chosen were those that are most often related to an increase in energy intake (i.e. sodas, sweetened beverages, high-fat foods, and fast foods) and also fruits, vegetables, and milk. Previous research assessing dietary intake in preschoolers found no relationship between reported energy intake and percent of calories from fat, carbohydrate, or protein with BMI. Therefore, rather than total energy intake or percent of calories, food groups were chosen to determine if dietary intake was related to BMI.

The FFQ was a component of the KAN-DO study baseline questionnaire (Appendix C) and was completed by the mothers enrolled in the study. Frequency of consumption was categorized as: none; not every day, but a least a few times/week; 1 time per day; 2 times per day; and 3 or more times per day. Survey questions 65 – 78 pertained to preschooler food frequency.

### ***Media use***

Questions 82 and 83 of the KAN-DO baseline survey ask about time spent watching TV and videos or using the computer by the preschoolers. These questions were based on a modified version of the Kaiser Physical Activity Survey (KPAS) (42). Eating while watching TV was assessed using question 84 (parts a – e) of the baseline survey. These questions are derived from Hesketh et al (43). The questions ask the mother to rate on a scale from “Never or Rarely” to “Every day” how often she and/or her preschooler eat meals and snacks while watching TV and videos. Question 81 asked

about televisions in the bedroom, and this was used to study the potential impact of having a TV in the bedroom on preschooler BMI.

### ***Physical activity***

Mothers were asked to estimate the hours and minutes spent by their child playing outdoors on a typical weekday and a typical weekend day – questions 86 and 87 of the baseline survey. This information was used to determine if the preschoolers are meeting physical activity recommendations.

### ***Statistical Analysis***

Statistical analyses were conducted using JMP statistical software version 7.0 (SAS, Cary, NC). Continuous variables are presented as mean (standard deviation), and categorical variables are expressed as percentages. Contingency tables and chi squared tests were used to compare categorical and one-way analysis of variance (ANOVA) for continuous variables between healthy, overweight, and obese children. Spearman correlations were used to assess bivariate relationships between food frequency and media use (TV/video and computer) and minutes of outdoor play.

A prediction model was used to determine if study variables and participant characteristics might be associated with preschooler BMI. The following variables were selected because they were hypothesized to be associated with preschooler weight status or because previous research has found significant relationships with preschooler weight status. Preschooler and maternal characteristics (child's gender, mother's baseline BMI, mother's education status, family income, mother's age, preschooler's age, and black/non-black race) and preschooler food frequency, media use, and outdoor play were

entered as independent variables. To decrease the levels of categorical variables, food frequency questionnaire responses and TV/computer use questions were collapsed. Table 3.3 shows questionnaire responses and how the variables were collapsed.

For TV/video use, media use guidelines from the American Academy of Pediatrics (i.e. media use for less than 2 hours per day) were used to form two response groups: watching TV < 2 hours per day and watching TV  $\geq$  2 hours per day. Since computer use by this age group was so small, computer use was divided into preschoolers using the computer < 1 hour per week and those using the computer  $\geq$  1 hour per week. The median minutes of outdoor play for both weekdays (< 90 minutes per day and  $\geq$  90 minutes per day) and weekends (< 120 minutes per day and  $\geq$  120 minutes per day) were used due to the wide distribution of reported minutes. The National Association of Sports and Physical Education guidelines (i.e. outdoor play for at least 60 minutes per day) were not used for the analysis due to the large number of preschoolers who were meeting these guidelines.

Bivariate analyses were performed to determine relationships between preschooler BMI and the independent variables: preschooler and maternal characteristics (child's gender, mother's baseline BMI, mother's education status, family income, mother's age, preschooler's age, and black/non-black race) and preschooler food frequency, media use, and outdoor play. Then stepwise regression analysis was used to assess the effect of food frequency, media use, and physical activity on preschooler BMI. Preschooler and maternal characteristics, food frequency responses, media use, and outdoor play were entered as independent variables in the model. Covariates to the

model were: mother's BMI, education level, age, employment status, and marital status; family income; and preschooler's gender, age, and race.

Three models were constructed. The first model included the covariates and TV/video viewing and computer use. This model also looked at the potential influence of meals and snacks eaten while watching TV and having a TV in the bedroom. The second model included all of the above variables and minutes of outdoor play. The third model included the covariates, media use, outdoor play, and food frequency responses. The level of significance to enter the model was set at  $p = 0.25$ , and the level of significance to exit the model was set at  $p = 0.50$ . For mother's age, preschooler's age, and mother's BMI, parameter estimates were set at 0.

## RESULTS

### *Demographic Information*

Three hundred and ninety mother-preschooler pairs were analyzed in this study. A total of 10 underweight preschoolers were excluded from analysis. Of the participants, 78.5% were white or other races (American Indian/Alaskan Native, Asian, or Native Hawaiian/Pacific Islander), and 21.5% were black. Mothers had a mean age of  $32.5 \pm 5.0$  years, and most were married (86.2%), had an income  $\geq \$60,001$  (56.8%), and had attended some college or higher (88.2%). The mothers' mean body mass index (BMI) was  $32.8 \pm 5.6 \text{ kg/m}^2$ . The preschoolers were on average  $3.5 \pm 1.0$  years old. Of the 390 preschoolers, 218 (55.9%) were boys and 172 (44.1%) were girls. The mean BMI of the boys was  $16.7 \pm 1.3 \text{ kg/m}^2$ , and the mean BMI for girls was  $16.5 \pm 1.5 \text{ kg/m}^2$ .

Table 3.2 presents the participant characteristics according to weight category of the preschoolers by the Centers for Disease Control and Prevention BMI percentiles for child gender and age. Using these guidelines, 74.4% were healthy weight, 15.9% were overweight, and 9.7% were obese. There were significant differences in maternal BMI between preschooler weight categories ( $p = 0.01$ ), with mothers of obese preschoolers having the highest maternal BMIs. There were no other significant differences between groups.

### ***Food Frequency***

The frequency of foods consumed by the preschoolers is presented in Table 3.3. Due to the low number of responses for some of the FFQ answers, and to maintain the integrity of the statistical analyses, some food frequency questionnaire responses were collapsed. Chi squared analysis revealed significant differences between the weight groups in the frequency of juice ( $p = 0.05$ ) and dessert ( $p = 0.003$ ) consumption. A greater percentage of healthy weight preschoolers ate dessert once a day, in comparison to overweight and obese preschoolers. At the same time, a greater percentage of obese preschoolers drank juice  $< 1$  time per day or  $\geq 2$  times per day than did healthy weight and overweight preschoolers. There were no significant differences between the weight groups in the quantity of juice, soda, and sweetened beverages and the type of milk consumed. There were no significant differences in consumption of the other foods among the weight groups.

Overall, 14.4% of the preschoolers drank  $< 1$  glass/day of milk, with 26.7% drinking 1 glass/day, 31.3% drinking 2 glasses/day and 27.7% drinking  $\geq 3$  glasses/day.



The preschoolers consumed little yogurt, with 36.2% of mothers reporting her preschooler ate no yogurt, 33.8% had < 1 serving/day, and 30.0% had at least one serving per day. As for vegetables, 19.5% of the preschoolers consumed them < 1 time/day, with 36.7% eating vegetables once per day and 43.8% reporting vegetables consumption 2 or more times per day. Only 12.3% ate fruit < 1 time/day, with 30% eating fruit 1 time/day and 47.3% having it  $\geq 2$  times/day.

As a whole, the preschoolers were unlikely to consume soda, with 76.7% of mothers reporting no soda consumption for her preschooler. Only 23.3% drank some soda. Sweetened beverage consumption was also low, with 50.1% drinking no sweetened beverages, 21.6% drinking sweetened beverages < 1 time/day, and 28.3% drinking sweetened beverages 1 or more times per day. As for juice, 35.4% of preschoolers drank juice < 1 time/day, 26.5% 1 time/day, 26.2% 2 times/day, and 11.9% had juice  $\geq 3$  times/day.

Looking at the preschoolers as a whole, 56.4% ate dessert < 1 time/day, 31.5% had dessert 1 time/day, and 12.1% ate dessert  $\geq 2$  times/day. The preschoolers also rarely ate fast foods, with 40.0% of mothers reporting that her preschooler had fast food < 1 time/week, 28.7% ate it 1 time/week, and only 31.3% ate fast food at least twice per week. As for French fries and chips, 27.7% ate no fries or chips, 51.8% ate them less than once per day, and 20.5% had fries or chips  $\geq 1$  times/day.

### ***Media Use and Outdoor Play***

Table 3.4 presents TV and computer use and minutes of outdoor play in the preschoolers by weight classification. Due to the low number of responses for some of

the media use answers, categories of media use were collapsed before statistical analyses were performed. Overall, 25.9% of the preschoolers had a television set in the bedroom. When looking at television use, 43.1% ( $n = 168$ ) of the preschoolers did not meet the American Academy of Pediatrics recommendation that children should not watch TV for more than 2 hours per day. The preschoolers rarely used the computer or played video games, with 71.8% of mothers reporting that her preschooler did so for less than one hour a week. There were no significant differences between the groups in TV or computer use or in having a TV in the bedroom. However, a higher percentage of obese children ate dinner while watching TV more often than healthy and overweight preschoolers ( $p = 0.001$ ).

On average, the preschoolers engaged in outdoor play for  $108.6 \pm 102.6$  minutes per day on weekdays and  $140.1 \pm 110.2$  minutes per day on weekends. Obese preschoolers participated in more minutes of outdoor play on weekends than did healthy weight or overweight preschooler ( $p = 0.02$ ). There were no other significant differences in minutes of outdoor play across the weight groups. The median minutes of outdoor play for the preschoolers as a whole were 90 on weekdays and 120 on weekend days. As a whole, 53.1% participated in outdoor play for more than the median minutes on weekdays, and 59.2% participated in outdoor play for more than the median minutes on weekend days. When looking at meeting the NASPE guidelines, 78.2% met the guidelines on weekdays and 84.6% met the guidelines on weekend days, engaging in more than 60 minutes of outdoor play per day.

When looking at relationships between TV and computer use, eating while watching TV, and minutes of outdoor play, preschoolers who snacked more while watching TV with their parents were also more likely to play outdoors for more than the median minutes on both weekdays ( $p = 0.02$ ) and weekend days ( $p = 0.04$ ). Preschoolers meeting the NASPE guidelines and playing outdoors for more than 60 minutes per day on weekend days watched more TV per day ( $p = 0.05$ ). Preschoolers engaging in more minutes of outdoor play on weekdays were more likely to snack while watching TV ( $p = 0.03$ ). Preschoolers engaging in more minutes of outdoor play on weekend days were less likely to have a TV in the bedroom ( $p = 0.02$ ) and were more likely to snack while watching TV with their parents ( $p = 0.05$ ).

#### ***Association between Food Frequency and Media Use***

Chi squared tests were used to investigate possible associations between food frequency and media use in the preschoolers. Having a TV in the bedroom was associated increased consumption of soda ( $p < 0.0001$ ), sweetened beverages ( $p < 0.0001$ ), fast food ( $p = 0.03$ ), fries ( $p = 0.0006$ ), and juice ( $p = 0.03$ ). Preschoolers without a TV in the bedroom consumed milk ( $p = 0.05$ ), yogurt ( $p < 0.0001$ ), and fruit ( $p = 0.0004$ ) more times per day than did preschoolers with a TV in the bedroom. Preschoolers with a TV in the bedroom consumed a greater quantity of juice ( $p = 0.04$ ) than did preschoolers without a TV in the bedroom.

Also using chi squared tests, watching more hours of TV each day was associated with more frequent consumption of soda ( $p = 0.0003$ ), sweetened beverages ( $p = 0.003$ ),

fries ( $p = 0.0002$ ), dessert ( $p = 0.03$ ), and juice ( $p = 0.0004$ ). There were no significant relationships between food frequency and computer use.

Food frequency was also found to be significantly associated with exceeding the AAP recommendations for media use. Using chi squared tests, preschoolers exceeding the AAP guidelines consumed a greater of soda ( $p < 0.0001$ ), sweetened beverages ( $p = 0.002$ ), fries ( $p < 0.0001$ ), dessert ( $p = 0.005$ ), and juice ( $p = < 0.0001$ ) than preschoolers not meeting the AAP guidelines.

#### ***Association between Food Frequency and Outdoor Play***

The relationships between minutes of outdoor play and frequency of food consumption were investigated. Playing outdoors for more minutes on the weekends was significantly associated with decreased consumption of sweetened beverages ( $p = 0.005$ ). Minutes of outdoor play on weekdays or weekends was not significantly associated with the frequency of consumption of any other foods.

Using outdoor play as a categorical variable, chi squared tests were used to look for relationships between the median minutes of outdoor play and food frequency and also meeting or not meeting the NASPE guidelines for physical activity on weekdays and weekends and food frequency. A greater percentage of preschoolers meeting or exceeding the weekday median minutes also consumed sweetened beverages ( $p = 0.02$ ) and vegetables ( $p = 0.04$ ) more frequently. Preschoolers exceeding the NASPE guidelines on weekends were more likely to consume milk ( $p = 0.05$ ). Preschoolers engaging in less than the median minutes of outdoor play on weekdays drank a greater quantity of sweetened beverages ( $p = 0.03$ ).

### ***Predictors of BMI in 2 to 5-year-olds***

Bivariate analyses were done to assess relationships between the independent variables and preschooler BMI. Eating dinner while watching TV ( $p = 0.007$ ), eating dinner with parents while watching TV ( $p = 0.03$ ), mother's education ( $p = 0.005$ ), dessert consumption ( $p < 0.0001$ ), mother's BMI ( $p = 0.003$ ), and child's age ( $p = 0.0007$ ) were significantly related with preschooler BMI.

To determine significant predictors of BMI in 2 to 5-year-olds, a regression analysis was used to assess the effect of food frequency, media use, and physical activity on preschooler BMI. Three stepwise models were constructed, and results are shown in Table 3.5. The first model was run with the covariates and media variables. Covariates in the model were mother's BMI, education level, employment status, marital status, and age; family income; and preschooler's gender, age, and race. The model accounted for 9.4% of the variance ( $r^2 = 0.094$ ) in preschooler BMI. Maternal BMI, eating dinner while watching TV, and preschooler age were the only significant predictors of preschooler BMI. Eating dinner while watching TV and preschooler age were the most significant predictors of preschooler BMI ( $p = 0.01$ ). The other variables were not significant predictors of preschooler BMI.

The next model included all of the above variables, in addition to the physical activity variables. Engaging in outdoor play for minutes below and greater than or equal to the median minutes for both weekdays and weekend days had no effect on preschooler BMI. Minutes of outdoor play itself was not significantly related to preschooler BMI so there was no change to the overall model ( $r^2 = 0.094$ ) with the addition of these variables.

The final model included all covariates, media variables, physical activity variables, and food frequency questionnaire responses. With the addition of the food frequency variables, the model did change. This model accounted for 18.5 % of the variance ( $r^2 = 0.185$ ) in preschooler BMI. Dessert consumption, mother's BMI, and eating dinner while watching TV were the only significant predictors. Dessert consumption was the most significant predictor ( $p = 0.0003$ ), with preschoolers consuming desserts more frequently having lower body mass indices. The other variables were not significant predictors of preschooler BMI in the final model. When the food frequency variables were added to the model, preschooler age was no longer a significant predictor of BMI.

## **DISCUSSION**

The participants of this study are a unique population, in that they are 2 to 5-year-olds born to overweight and obese mothers. No published research exists to date investigating the dietary habits, media usage, and physical activity levels of such a group. As shown in previous research, having a mother who is overweight (BMI = 25.0 – 29.9 kg/m<sup>2</sup>) or obese (BMI  $\geq$  30 kg/m<sup>2</sup>) increases a child's risk of being overweight or obese himself (9, 21, 44-46). When using the CDC growth charts, 14.9% of the preschoolers were overweight (BMI  $\geq$  85<sup>th</sup> percentile and  $<$  than 95<sup>th</sup> percentile), and 10% were considered obese (BMI  $\geq$  95<sup>th</sup> percentile). This 24.9% prevalence of overweight/obesity is similar to the prevalence of overweight and obesity reported from the 2003-2006 NHANES (2), where 24.4% of 2 to 5-year-olds were found to be overweight or obese.

Previous research indicates that as rates of childhood obesity have increased, so has children's consumption of fast foods and sweetened beverages, including soft drinks and sweetened fruit drinks. Several studies suggest increased sweetened beverage and soda consumption increases the likelihood of becoming overweight or obese (20, 25, 47-50). In this study, there were significant differences between the weight groups in the consumption of juice and dessert. Healthy weight preschoolers were more likely to consume dessert once a day than were overweight and obese preschoolers, who were more likely to consume either  $< 1$  dessert a day or  $\geq 2$  desserts a day. This could be due to maternal involvement and a belief in the idea of moderation. Mothers who allow their children to eat dessert once per day may be creating healthy habits that foster portion control and thus weight management. In support of previous research, obese preschoolers were more likely to consume juice than were healthy weight and overweight preschoolers.

Also in this study, the quantity of juice, soda, and sweetened beverage, along with the type of milk, consumed did not differ across the weight groups. Soda, fast food, and yogurt consumption were minimal in the preschoolers as a whole. The lack of differences in consumption in the foods besides juice and dessert could be due to underreporting on the part of the mothers. This study found significant differences in maternal BMI between preschooler weight categories, with mothers of obese preschoolers having the highest maternal BMIs. These women of higher weight status may underreport their preschoolers' intakes in order to report what they think they should report.

Studies also indicate that an increase in the hours of television and videos watched is related to increased obesity (7, 22, 41, 46). Computer and video game use may also impact obesity by increasing the time preschoolers spend engaged in sedentary activity (32-34). However, some studies do show that there is no relationship between TV viewing and weight status (34) or between video game and computer use and obesity (51, 52). In this study, there were no significant differences between weight groups in TV viewing or computer use. The preschoolers rarely used the computer or played video games. Nearly three-fourths of mothers reported that their child used the computer for less than an hour a week.

When further looking at television use by the preschoolers in this study, 43.1% ( $n = 168$ ) of the preschoolers were not meeting the American Academy of Pediatrics (AAP) recommendation that children should not watch TV for more than 2 hours per day. This number exceeds previous estimates that one-third of preschoolers exceed the AAP recommendation (37). Some research indicates that children who watch more than two hours of television each day are more likely to be overweight (38). Researchers in the GENESIS study (53) found that obesity was significantly more prevalent among preschoolers watching  $\geq 2$  hours/day of TV than among those watching  $< 2$  hours/day ( $p = 0.003$ ). They also found that children watching  $\geq 2$  hours/day of TV were 30% more likely to be obese than those watching less. In this study, however, there were no significant differences in meeting the guidelines between weight classifications. There was also no significant association between meeting or not meeting the recommendations



and preschooler BMI. Nor was watching  $\geq 2$  hours/day of TV associated with overweight/obesity.

Eating dinner while watching TV was found to be significantly related to preschooler weight classification. Overweight and obese children were more likely to eat dinner while watching TV. This result supports previous findings that exposure to television while eating may increase intake (54). This could be because when children are preoccupied by the TV, they are less likely to be aware of cues of fullness and thus continue to eat. There was no difference among the groups in whether or not there was a TV in the bedroom. Other research suggests this may increase the risk of overweight (55), but those results were not found in this study.

Higher activity levels are associated with lower BMI, even in preschoolers (21), and previous research shows that nearly half of preschool-aged children do not engage in sufficient physical activity (40). In this study, obese preschoolers were more likely to engage in more minutes of outdoor play on weekends than were healthy weight or overweight preschoolers. This raises questions about the use of BMI as an indicator of weight status in preschoolers, as perhaps the obese preschoolers were more muscular than the healthy weight and overweight preschoolers. There were no other significant differences in minutes of outdoor play across the weight groups. The National Association of Sports and Physical Education (NASPE) recommends outdoor play for at least 60 minutes per day (39). The median minutes of outdoor play for preschoolers in this study was 90 minutes/day on weekdays and 120 minutes/day on weekends. Most preschoolers in this study are thus meeting physical activity recommendations.

This study also found that preschoolers who snacked with their parents while watching TV were also more likely to play outdoors on both weekdays and weekends. This could again be attributed to parental involvement. If parents are watching TV with their preschoolers, then they likely have more control over the amount that is being eaten and may encourage their preschoolers to engage in more outdoor play. Preschoolers engaging in more minutes of outdoor play on weekend days were less likely to have a TV in the bedroom, suggesting that these preschoolers may be less likely to substitute active play with sedentary activities, such as watching TV.

Previous research suggests that TV may influence the foods that children eat, thereby impacting weight status (30). Excessive TV viewing is associated with higher intakes of energy, fat, snacks, and sodas, as well as with lower intakes of fruits and vegetables (28, 29). In this study, watching more hours of TV each day was associated with consuming soda, sweetened beverages, fries, dessert, and juice more frequently. There were no significant relationships between food frequency and computer use. This could be due to the overall low computer use or to the fact that using the computer requires using your hands, decreasing the ability to eat or drink. These results do support the previous research in that increased TV viewing is also associated with increased sweetened beverage, fruit juice, soda, and snack food consumption.

No previous research exists on the effects on food consumption in preschoolers with a TV in the bedroom. In this study, having a TV in the bedroom was associated increased consumption of soda, sweetened beverages, fast food, fries, and juice. Not having a TV in the bedroom was associated with increased consumption of milk, yogurt,

and fruit. Preschoolers with a TV in the bedroom also consumed a greater quantity of juice than did those without a TV in the bedroom. This could be attributable to healthier lifestyle choices on the part of the preschoolers' parents. Preschoolers without TVs in the bedroom may have parents who see this as an unhealthy habit in this age group. This is then also likely to be associated with other healthy habits, such as decreased consumption of soda, sweetened beverages, fast food, fries, and juice.

Manios et al. found that, among preschoolers in the GENESIS study, total energy intake and fat intake was significantly greater in children exceeding AAP TV guidelines and watching  $\geq 2$  hours/day of TV each day than in children watching less than 2 hours. Preschoolers watching  $\geq 2$  hours/day also ate more exchanges of bread, meat, fat, and other carbohydrates (including sweets and soft drinks) and more fruit and vegetable exchanges than did those watching less TV (23). Among preschoolers in this study, exceeding the AAP guidelines for media use was associated with increased consumption of fruit juice, French fries and chips, sweetened beverages, soda, and dessert. The results of this study support the findings of Manios et al. in that watching more TV is found to be associated with an increased intake of high calorie, high sugar, and high fat foods.

There is no research to date that investigates the relationships between outdoor play and food frequency in 2 to 5-year-olds. Some research has shown no significant interaction among total energy intake, physical activity, TV viewing time, and the probability of being obese (53). In this study, minutes of outdoor play was studied for its possible association with frequency of food consumptions. Increased outdoor play on the weekends was significantly associated with increased consumption of sweetened

beverage, but there was no significant association with the frequency of consumption of any other foods. This could be due to the fact that as children play outdoors, their thirst may increase, and these preschoolers are more likely to drink a sweetened beverage to quench this thirst than they are to drink other types of beverages.

The most significant predictors of overweight/obesity ( $\text{BMI} \geq 85^{\text{th}}$  percentile) in preschoolers were dessert consumption, preschooler's age in years, mother's BMI, and eating dinner while watching TV. Dessert was the most significant predictor of preschooler BMI, with preschoolers eating dessert at least 1 time per day having lower BMIs than preschoolers eating dessert less than 1 time per day. This again supports the idea that mothers who allow their preschoolers to eat some dessert may be fostering healthier habits than mothers who restrict desserts of mothers allow their preschoolers to eat dessert at will. Jago et al. found that the interactions between both minutes of TV viewing per hour and minutes of physical activity per hour and years enrolled in the study were significant in predicting BMI among 3 to 7-year-olds. They used mean daily caloric intake and percent total daily calories from macronutrients as a means of dietary assessment. Although a different means of dietary assessment was used than in this study, the researchers still did not find diet to be a significant predictor of BMI (56). In preschoolers, dietary, media use, and physical activity habits may not be developed enough to be significant predictors of BMI.

Media use, outdoor play, and all other food frequency variables were not found to be significant predictors of overweight or obesity in the preschoolers. Dennison et al. determined that the risk having a  $\text{BMI} > 85^{\text{th}}$  percentile increased 6% for each additional

hour of TV over 2 hours viewed per day, but the results of this study did not support their findings (55). Physical activity did not appear to have an effect on predicting preschooler BMI. Preschooler age was significant when looking at covariates and media variables, with older preschoolers having lower body mass indices. However, when the food frequency variables were added, preschooler age was no longer a significant predictor of BMI.

### ***Limitations***

There are several limitations to this study. First, the food frequency questionnaire (FFQ) used to assess dietary intake has not been validated. Thus there are the inherent limitations when using a FFQ, particularly one that has not been validated. Study participants may have had difficulty understanding the questions or the responses determining frequency of intake. With the mothers serving as proxies for their preschoolers, there may have been under or over-reporting on the part of the mothers. The mothers may not always be with their preschoolers, as they are in daycare or school during the week. Thus mothers may not always be fully aware of what their children are eating. There may also have been inaccuracy in reporting television viewing and computer use. Due to the open-ended nature of the outdoor play questions, mothers may have also overestimated the time their 2 to 5-year-olds spend engaged in outdoor play. Misreading of the questions may have led mothers to report total week and weekend play, as opposed to a single day.

Other aspects of this study may limit the applications of its results to the population as a whole. Three-fourths of participants in this study were white, thereby

limiting its applications to minority groups. Also the mothers in this study tended to be more educated and have higher incomes. This may mean that the participants in this study were generally already more knowledgeable about healthy eating and physical activity.

### ***Conclusions***

Associations between food frequency and TV viewing and computer use and between food frequency and outdoor play may lead to the establishment of lifestyle patterns, even in preschoolers. In preschoolers, soda, sweetened beverage, fast food, French fries and chips, and dessert consumption may not be to blame for the high prevalence of overweight and obesity. However, due to the association of these food groups with increased TV/video viewing and increased outdoor play, associations among food frequency, media use, outdoor play, and obesity may not develop until later in childhood.

### ***Future Research***

Future research in overweight and obesity in 2 to 5-year-olds should focus on the use of more accurate and valid means of assessment. Validated food frequency questionnaires should be used along side 24-hour dietary recalls to determine accuracy of FFQ responses. Alternative methods beside survey questions should be used to assess physical and sedentary activity. The use of accelerometry data should be used in conjunction with survey questions. The use of a daily physical activity and media use log may also be helpful in assessing physical and sedentary activity. Also a more diverse

study population should be used, to include more diversity in race, socioeconomic status, and education levels.

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## **TABLES**

**Table 3.1: Definition of Study Variables**

<b>Study Variable</b>	<b>Definitions</b>	<b>Categories (for Categorical variables)</b>
<b>Dietary Intake</b>	Frequency of food consumption, food frequency	
<i>Soda</i>	Does not include diet soda	None; Not every day but at least a few times per week; $\geq 1$ time per day
<i>Sweetened beverages</i>	Sweet tea, punch, Kool-aid, sports drinks, fruit drinks – no sodas, diet drinks, 100% fruit juice	None; Not every day but at least a few times per week; 1 time per day; $\geq 2$ times per day
<i>Juice</i>	100% fruit juice, no sugar added	< Once per day; 1 time per day; 2 times per day; $\geq 3$ times per day
<i>Fast food</i>		< Once per week; 1 time per week; $\geq 2$ times per week
<i>French fries and chips</i>	Potato chips, tortilla chips, Cheetos, corn chips, other snack chips	None; Not every day but at least a few times per week; $\geq 1$ time per day
<i>Milk</i>		< 1 glass per day; 1 glass per day; 2 glasses per day; $\geq 3$ glasses per day
<i>Yogurt</i>		None; Not every day but at least a few times per week; $\geq 1$ time per day
<i>Desserts and sweets</i>		None; < one serving per day; $\geq 1$ time per day
<i>Vegetables</i>	Not including French fries	< 1 serving per day; 1 serving per day; $\geq 2$ servings per day
<i>Fruits</i>	Not including 100% fruit juice	< 1 serving per day; 1 serving per day; 2 servings per day; $\geq 3$ servings per day
<b>Media Use</b>	Television, videos, video games, computer	Categorical
<i>TV in the bedroom</i>		Yes / No
<i>TV viewing</i>	Watching TV or videos	< 1 hour a day; At least 1 hours a day but < 2 hours a day; At least 2 hours a day but < 4 hours a day; $\geq 4$ hours a day

<i>TV viewing</i>	Used in model	< 2 hours a day; $\geq$ 2 hours a day
<i>Computer use</i>	Using a computer or playing video games	< 1 hour a week; At least 1 hours a day but < 2 hours a day; At least 1 hour a day
<i>Computer use</i>	Used in model	< 1 hour a week; $\geq$ 1 hour a week
<i>Preschooler eating dinner in front of the TV</i>	Frequency in the past 30 days	Never or rarely; < once a week; Once a week; 2-3 times per week; 4-6 times per week; Every day
<i>Preschooler eating snacks in front of the TV</i>	Frequency in the past 30 days	Never or rarely; < once a week; Once a week; 2-3 times per week; 4-6 times per week; Every day
<i>Preschooler eating dinner in front of the TV with parent</i>	Frequency in the past 30 days	Never or rarely; < once a week; Once a week; 2-3 times per week; 4-6 times per week; Every day
<i>Preschooler eating snacks in front of the TV with parent</i>	Frequency in the past 30 days	Never or rarely; < once a week; Once a week; 2-3 times per week; 4-6 times per week; Every day
<b>Physical activity</b>	Minutes of outdoor play	Continuous
<i>Weekday</i>	Used as categorical variable in model	< 90 minutes/day; $\geq$ 90 minutes/day
<i>Weekend day</i>	Used as categorical variable in model	< 120 minutes/day; $\geq$ 120 minutes/day
<b>Body mass index (BMI)</b>	Weight / height <sup>2</sup> (kg/m <sup>2</sup> ).	Continuous
<b>Weight class</b>	BMI category based on CDC BMI percentiles – underweight, healthy weight, overweight, obese	Underweight: < 5 <sup>th</sup> percentile; Healthy weight: 5 <sup>th</sup> to 84 <sup>th</sup> percentile; Overweight: 85 <sup>th</sup> to 94 <sup>th</sup> percentile; Obese: $\geq$ 95 <sup>th</sup> percentile



<b>Table 3.2 Baseline Characteristics by Preschooler BMI Classification</b>				
<b>Preschoolers' Characteristics</b>		<b>Healthy Weight n = 290</b>	<b>Overweight n = 62</b>	<b>Obese n = 38</b>
<b>Gender</b>	<i>n (%)</i>			
	Boys	161 (55.5)	35 (56.5)	22 (57.9)
	Girls	129 (44.5)	27 (43.5)	16 (42.1)
<b>Age</b>	<i>years (SD)</i>			
	Boys	3.4 (1.1)	3.8 (1.1)	3.9 (0.9)
	Girls	3.5 (1.0)	3.5 (1.0)	3.7 (1.1)
<b>Weight</b>	<i>kg (SD)</i>			
	Boys	15.9 (2.6)	18.4 (3.6)	20.3 (3.3)
	Girls	15.1 (2.5)	17.2 (2.9)	20.0 (4.1)
<b>Height</b>	<i>cm (SD)</i>			
	Boys	99.0 (8.9)	101.9 (10.8)	103.0 (8.2)
	Girls	97.4 (8.0)	98.3 (9.4)	100.4 (10.7)
<b>BMI</b>	<i>kg/m<sup>2</sup> (SD)</i>			
	Boys	16.1 (0.9)	17.6 (0.5)	19.0 (1.1)
	Girls	15.8 (0.9)	17.7 (0.6)	19.7 (1.3)
<b>BMI z-score</b>				
	Boys	0.13 (0.66)	1.28 (0.17)	2.13 (0.48)
	Girls	0.10 (0.63)	1.34 (0.16)	2.15 (0.47)
<b>Mothers' Characteristics</b>				
<b>Age</b>	<i>years (SD)</i>			
		32.7 (5.1)	31.9 (4.6)	32.6 (4.7)
<b>Race</b>	<i>n (%)</i>			
	Non-Black	230 (79.3)	47 (75.8)	29 (76.3)

	Black	60 (20.7)	15 (24.2)	9 (23.7)
<b>Work for pay</b>	<i>n (%)</i>			
	Full-time	76 (26.2)	26 (41.9)	14 (36.8)
	Part-time	61 (21.0)	9 (14.5)	5 (13.2)
	Do not work for pay	153 (52.8)	27 (43.5)	19 (50.0)
<b>Education</b>	<i>n (%)</i>			
	High school or less	29 (10.0)	10 (16.1)	7 (18.4)
	Some college or college degree	185 (63.8)	36 (58.1)	21 (55.3)
	Postgraduate degree	76 (26.2)	16 (25.8)	10 (26.3)
<b>Income</b>	<i>n (%)</i>			
	Up to \$15,000	28 (9.8)	7 (11.5)	5 (13.5)
	\$15,001 - \$30,000	25 (8.7)	8 (13.1)	1 (2.7)
	\$30,001 - \$45,000	24 (8.4)	3 (4.9)	7 (18.9)
	\$45,001 - \$60,000	45 (15.7)	7 (11.5)	6 (16.2)
	\$60,001 or more	164 (57.3)	36 (59.0)	18 (48.6)
<b>Marital Status</b>	<i>n (%)</i>			
	Single and never married	23 (7.9)	6 (9.7)	4 (10.5)
	Living with partner	11 (3.8)	2 (3.2)	2 (5.3)
	Married	252 (86.7)	52 (83.9)	32 (84.2)
	Divorced	4 (1.4)	2 (3.2)	0 (0)
<b>BMI <sup>a</sup></b>	<i>kg/m<sup>2</sup> (SD)</i>	32.4 (5.6)	33.7 (5.3)	35.1 (6.3)
ANOVA: <sup>a</sup> $p = 0.01$ Healthy weight: BMI $\geq$ 5th percentile and $<$ 85th percentile Overweight: BMI 85th - 94.9th percentile, Obese: BMI $\geq$ 95th percentile				

<b>Table 3.3 Food Frequency by Preschooler BMI Classification</b>				
<b>Food Type</b>	<b>Times/day</b>	<b>Healthy Weight n = 290</b>	<b>Overweight n = 62</b>	<b>Obese n = 38</b>
<b>Soda</b>	No	226 (77.9)	45 (72.6)	28 (73.7)
	Yes	64 (22.1)	17 (27.4)	10 (26.3)
<b>Sweetened Beverage</b>	None	151 (52.2)	24 (38.7)	20 (52.6)
	Not every day, but a few times a week	60 (20.8)	18 (29.0)	6 (15.8)
	1 time per day	34 (11.8)	12 (19.4)	5 (13.2)
	2 or more times per day	44 (15.2)	8 (12.9)	7 (18.4)
<b>Juice <sup>a</sup></b>	< 1 time per day	97 (36.1)	14 (25.0)	17 (45.9)
	1 time per day	71 (26.4)	20 (35.7)	5 (13.5)
	2 times per day	65 (24.2)	16 (28.6)	14 (37.8)
	3 or more times per day	36 (13.4)	6 (10.7)	1 (2.7)
<b>Fast Food</b>	None or less than once per week	123 (42.4)	16 (25.8)	17 (44.7)
	1 time per week	82 (28.3)	22 (35.5)	8 (21.1)
	2 or more times per week	85 (29.3)	24 (38.7)	13 (34.2)
<b>Fries &amp; Chips</b>	None	86 (29.7)	14 (22.6)	8 (21.1)
	Not every day, but a few times a week	145 (50.0)	37 (59.7)	20 (52.6)
	1 or more times per day	59 (20.3)	11 (17.7)	10 (26.3)
<b>Milk</b>	Less than one glass per day	46 (15.9)	7 (11.3)	3 (7.9)

	1 glass per day	78 (26.9)	15 (24.2)	11 (28.9)
	2 glasses per day	93 (32.1)	15 (24.2)	14 (36.8)
	3 or more glasses per day	73 (25.2)	25 (40.3)	10 (26.3)
<b>Yogurt</b>	None	105 (36.2)	23 (37.1)	13 (34.2)
	< 1 serving per day	96 (33.1)	24 (38.7)	12 (31.6)
	1 or more times per day	89 (30.7)	15 (24.2)	13 (34.2)
<b>Dessert <sup>b</sup></b>	< 1 serving per day	147 (50.7)	44 (71.0)	29 (76.3)
	1 serving per day	106 (36.6)	12 (19.4)	5 (13.2)
	2 or more servings per day	37 (12.8)	6 (9.7)	4 (10.5)
<b>Vegetables</b>	< 1 serving per day	57 (19.7)	11 (17.7)	8 (21.1)
	1 serving per day	101 (34.8)	27 (43.5)	15 (39.5)
	2 or more servings per day	132 (45.5)	24 (38.7)	15 (39.5)
<b>Fruit</b>	< 1 serving per day	30 (10.4)	12 (19.4)	7 (18.9)
	1 serving per day	64 (29.1)	19 (30.6)	11 (29.7)
	2 servings per day	112 (38.8)	21 (33.9)	12 (32.4)
	3 or more servings per day	63 (21.8)	10 (16.1)	7 (18.9)
<p><i>n</i> (%)</p> <p>Chi square test: <sup>a</sup><i>p</i> = 0.05, <sup>b</sup><i>p</i> = 0.003</p> <p>Healthy weight: BMI ≥ 5th percentile and &lt; 85th percentile</p> <p>Overweight: BMI 85th - 94.9th percentile</p> <p>Obese: BMI ≥ 95th percentile</p>				

<b>Table 3.4 Media Use and Physical Activity Habits by Preschooler BMI Classification</b>				
		<b>Healthy Weight n = 290</b>	<b>Overweight n = 62</b>	<b>Obese n = 38</b>
<b>TV in bedroom</b>	Yes	70 (24.1)	19 (30.6)	12 (31.6)
	No	220 (75.9)	43 (69.4)	26 (68.4)
<b>TV / video hours</b>	<1 hr a day	61 (21.0)	18 (29.0)	7 (18.4)
	≥1 hr but <2 hr per day	102 (35.2)	23 (37.1)	11 (28.9)
	≥2 hr per day	127 (43.8)	21 (33.9)	20 (52.6)
<b>AAP Guidelines</b>	Met (<2 hr per day)	163 (56.2)	41 (66.1)	18 (47.4)
	Exceeded (≥2 hr per day)	127 (43.8)	21 (33.9)	20 (52.6)
<b>Computer hours</b>	<1 hr per week	215 (74.1)	41 (66.1)	24 (63.2)
	≥1 hr a wk	75 (25.9)	21 (33.9)	14 (36.8)
<b>Eating dinner in front of TV <sup>a</sup></b>	Less than once a week	169 (69.5)	30 (61.2)	13 (38.2)
	Once a week	15 (6.2)	3 (6.1)	3 (8.8)
	About 2-3 times per week	26 (10.7)	8 (16.3)	13 (38.2)
	At least 4 times per week	33 (13.6)	8 (16.3)	5 (14.7)
<b>Eating snacks in front of TV</b>	Less than once a week	81 (33.3)	23 (46.9)	7 (21.2)
	Once a week	32 (13.2)	5 (10.2)	4 (12.1)
	About 2-3 times per week	72 (29.6)	14 (28.6)	12 (36.4)

	At least 4 times per week	58 (23.9)	7 (14.3)	10 (30.3)
<b>Eating dinner in front of TV with parents</b>	Less than once a week	168 (69.1)	32 (65.3)	16 (47.1)
	Once a week	18 (7.4)	3 (6.1)	5 (14.7)
	About 2-3 times per week	26 (10.7)	9 (18.4)	7 (20.6)
	At least 4 times per week	31 (12.8)	5 (10.2)	6 (17.6)
<b>Eating snacks in front of TV with parents</b>	Less than once a week	127 (52.5)	29 (59.2)	12 (35.3)
	Once a week	45 (18.6)	7 (14.3)	7 (20.6)
	About 2-3 times per week	43 (17.8)	9 (18.4)	10 (29.4)
	At least 4 times per week	27 (11.2)	4 (8.2)	5 (14.7)
<b>Outdoor Play <sup>b</sup></b>	<i>Mean minutes (SD)</i>			
	Weekday	104.6 (98.6)	110.4 (96.4)	135.8 (135.6)
	Weekend	135.3 (104.4)	132.6 (103.6)	188.7 (148.8)
<b>NASPE Guidelines</b>	Weekday			
	Not met (<60 min per day)	67 (23.1)	12 (19.4)	6 (15.8)
	Met (≥60 min per day)	223 (76.9)	50 (80.6)	32 (84.2)
	Weekend			
<b>Outdoor Play meeting median minutes</b>	Not met (<60 min per day)	44 (15.2)	14 (22.6)	2 (5.3)
	Met (≥60 min per day)	246 (84.8)	48 (77.4)	36 (94.7)
	Weekday (90 minutes/day)			
	No	136 (46.9)	31 (50.0)	16 (42.1)
	Yes	154 (53.1)	31 (50.0)	22 (57.9)
	Weekend (120 minutes/day)			
	No	121 (41.7)	28 (45.2)	10 (26.3)
	Yes	169 (58.3)	34 (54.8)	28 (73.7)

n (%)

Chi square test: <sup>a</sup> $p = 0.001$ ; ANOVA: <sup>b</sup> $p = 0.02$

Healthy weight: BMI  $\geq$  5th percentile and  $<$  85th percentile

Overweight: BMI 85th - 94.9th percentile

Obese: BMI  $\geq$  95th percentile

<b>Table 3.5 Multivariate Analysis: Significant Predictors of Preschooler BMI (stepwise regression)</b>						
	<b>Model 1</b>		<b>Model 2</b>		<b>Model 3</b>	
<b><i>R</i><sup>2</sup></b>	9.4		9.4		18.5	
<b><i>Intercept</i></b>	16.3		16.3		16.2	
	<b>Preschooler BMI (kg/m<sup>2</sup>)</b>		<b>Preschooler BMI (kg/m<sup>2</sup>)</b>		<b>Preschooler BMI (kg/m<sup>2</sup>)</b>	
<b>Variable</b>	<b>Effect Size</b>	<b>p value *</b>	<b>Effect Size</b>	<b>p value *</b>	<b>Effect Size</b>	<b>p value *</b>
<b>Dessert<sup>a</sup></b>						<b>0.0003</b>
1 time per day					-0.69	
≥ 2 times per day					-0.40	
<b>Dinner in front of the TV<sup>b</sup></b>		<b>0.01</b>		<b>0.01</b>		<b>0.01</b>
Once a week	0.23		0.23		0.27	
2-3 times per week	0.73		0.73		0.69	
At least 4 times per week	0.48		0.48		0.37	
<b>Mother's body mass index (kg/m<sup>2</sup>)</b>	0.032	<b>0.02</b>	0.032	<b>0.02</b>	0.042	<b>0.003</b>
<b>Preschooler's age</b>	-0.19	<b>0.01</b>	-0.19	<b>0.01</b>		

Reference categories: <sup>a</sup> < 1 time per day; <sup>b</sup> < once a week; Mother's BMI and Preschooler's age based on reference of 0  
 $p < 0.05$

**Model 1:** all covariates (mother's BMI, education level, age, employment status, and marital status; family income; and preschooler's gender, age, and race) and media variables (TV/video viewing and computer use; dinner and snacks while watching TV; having a TV in the bedroom)

**Model 2:** all in the above model, plus median minutes of outdoor play

**Model 3:** all in Model 1 and Model 2, plus food frequency variables



## **CHAPTER IV**

### **EPILOGUE**

I began my Masters thesis research in the fall of 2007. I started as a graduate research assistant for Dr. Lovelady, working on the KAN-DO study. My responsibilities with KAN-DO were varied. I conducted screen phone calls of potential study participants and scheduled baseline visits, and I conducted baseline visits with moms and preschoolers, reviewing consent forms and taking anthropometric measurements. I was also able to participate in writing, reviewing, and editing the study's intervention materials. The bulk of my work involved completing 24-hour dietary recalls over the telephone using NDSR (Nutrition Data System for Research) computer software, first on mothers in KAN-DO and later also on the preschoolers.

In working with the mothers in KAN-DO, I became interested in looking at the eating habits of the women's preschoolers. With recent increases in rates of childhood obesity, I began to wonder if there were food habits that, even in preschoolers, could be commonly associated with overweight and obesity. I also started thinking about our society as a whole and the increased use of televisions and computers, which is commonly accompanied with a decrease in exercise and physical activity. With these thoughts in mind, I began to question if particular foods, along with television and physical activity habits, might be associated with preschooler overweight. Therefore, I decided to describe dietary habits, media use, and physical activity in preschoolers born

to overweight and obese mothers and then to determine if these factors influence their risk for overweight and obesity. I compared the food consumption frequency, hours of media use, and minutes of outdoor play among healthy weight, overweight, and obese preschoolers and then determined if these factors could be used to predict BMI in preschoolers.

Data for my thesis was taken from questions in the baseline survey of KAN-DO. The surveys were mailed to participants after screening so that they could be completed and given to the research staff at the baseline visit. Surveys were then checked by the research staff for completeness. The surveys contained a short food frequency questionnaire, along with questions about physical activity, television viewing, and computer use. There were also questions about eating while watching TV. I hoped with the large amount of available data on the 400 preschoolers in the KAN-DO study I could find habits that may be more likely to promote overweight in preschoolers.

Through the duration of the study, there were five versions of the baseline survey. With the different versions, responses to some of the food frequency questionnaire items varied. For that reason, the KAN-DO Baseline Survey FFQ Version Codebook was created. The codebook provided the text of the different question versions, with the major differences between versions noted. The frequency distributions for all versions of the questions were also included. Before the food frequency data could be analyzed, the survey versions had to be collapsed to create a single version for each question, and the codebook provided guidelines for creating the single version. Then, to maintain the

integrity of the statistical analyses done in the study, the frequency distributions were used to collapse response categories.

This research assessed the dietary intake, media use, and physical activity habits of preschoolers born to overweight and obese mothers. This research also looked at differences in these factors among healthy weight, overweight, and obese preschoolers and then looked at potential predictors of preschooler BMI. This research supports the importance of family meals. Preschoolers who ate meals while watching TV were more likely to be overweight than preschoolers not watching TV while eating meals. It also emphasizes the importance of moderation in the diet, even in preschoolers. Preschoolers who ate some desserts were less likely to be overweight or obese than preschoolers eating no dessert or eating more desserts. The findings of this study overall emphasize the importance of parental involvement. Healthy behaviors – eating in moderation, increased outdoor play, and decreased television use – typically occurred in tandem, and in preschoolers this could be due to increased parental involvement.

In future research, I would like to use the results of this study to develop nutrition education programs and materials for parents. Being able to show parents such telling results may have a greater impact in encouraging them to adopt healthy habits for their families. I would also like to investigate the types of programs being viewed by the preschoolers to assess the influence of TV on food choices in this age group. Overall, this research contributes to the literature in showing potential contributors to the recent increases in rates of childhood obesity.

## APPENDIX A: SCREENING FORM

## KAN-DO screening data entry form

Study ID: \_\_\_\_\_ Site : \_\_\_\_\_  
Screening Date: \_\_\_\_\_ Screened by: \_\_\_\_\_

Recruitment source: (e.g., postcard) \_\_\_\_\_  
Recruitment place: (e.g., OB/GYN office) \_\_\_\_\_

Question	answer	Eligibility	comments
Did woman lose baby?	Y N	must be NO	
1. What is your date of birth?	/ /	must be >18	
2. When did you deliver your baby?	/ /	must be <22 weeks	
3. Do you have any children between the ages of 2 and 6?	Y N	must be YES	
4. What are the birthdates of all your children (youngest to oldest)	/ /	(list youngest to oldest)	
We are studying mother and one preschool child. In order to select just one child, we are picking the one with the birthday that falls earliest in the year. That would be your child born on _____ Target	/ /		
Child's Name is: _____	/ /		
	/ /		
What is the (target) child's name?			
6. What is the sex of (name) _____?	M F		
8. Do you have any health conditions that prevent you from walking a mile?	Y N	must be NO	
7. Does the target child have any conditions that prevent him/her from exercising?	Y N	must be NO	
8. How would you describe your marital status?		single and never married, married, living with partner, divorced, separated, widowed	
8. How would you describe your race?		1=White, 2=Black, 3=American Indian/Alaskan Native, 4=Asian, 5=Native Hawaiian/Pacific Islander, 99=Other	
10. Do you consider yourself to be Hispanic or Latina?	Y N		
11. What is your current height without shoes?		(nearest .25 inches)	
12. What was your weight before you become pregnant? _____ lbs Weight now? _____ lbs		(nearest pound)	
Estimated BMI from chart		must be >25	
13. Do you have regular access to a telephone and a permanent mailing address so that we may contact you?	Y N	must be YES	
14. What is the best phone number to contact you and time to reach you?			

Contact Information: Mother Name: _____ Child Name: _____ Address: _____ City/State/Zip: _____  (1 mailing 1 shipping 1 both)	phone #: _____ phone #: _____ phone #: _____ email: _____	Status Refused Y N Eligible Y N Reason not eligible:  BV#1 appt date/time/staff:
---	--	---

## APPENDIX B: DUKE UNIVERSITY CONSENT FORM



## DUKE UNIVERSITY HEALTH SYSTEM

### Consent To Participate In A Research Study

KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity

#### Introduction

The Duke University Medical Center (DUMC) and The University of North Carolina at Greensboro (UNCG) are conducting a research study about the importance of preventing children from becoming overweight. As a woman who recently delivered a baby and is the parent of a child between 2 and 5, you and your preschooler are eligible to participate in this study. This study is being sponsored by a grant from the National Institutes of Health (NIH). Portions of Dr. Østbye's, Dr. Lovelady's and the research team's salaries are being paid by this grant.

Research studies include only people who choose to take part. Please read this consent form carefully and take your time making your decision. As your study staff discusses this consent form with you, please ask him/her to explain any words or information that you do not clearly understand and answer any questions you may have. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

#### Purpose of the Study

The goal of the study is to determine whether the KAN-DO intervention can encourage healthy eating, increased physical activity, and healthy weights among participating women and their children.

#### How the Study Works

Women who recently had a baby in the Raleigh/Durham/Chapel Hill or Greensboro/Winston-Salem/High Point regions of North Carolina, and also have a child aged 2-5, are English speaking, and are age 18 or older will be eligible to participate. A total of 400 women and 400 children will be enrolled in the study. The study will take place over the course of about 2 years.

If you agree to be in the study, we will ask you and your child to visit us at Duke (for the Triangle families) or UNCG for the Triad families). We will have you sign this consent form and we will give you a copy for your records. At that visit, we will weigh and measure you and your child. We will measure your waist and hip circumference. You will be asked to complete a 30-minute paper and pencil survey about your family's health and parenting behaviors. When you and your child attend a one-hour session at either DUMC or UNCG, you will be fitted for an activity monitor that you will both wear for one week, and then return via pre-paid envelope or in person. After your visit, you will be called by The University of North Carolina – Greensboro for a detailed 20-30 minute survey about your diet on two separate days within a two-week period. Immediately following that survey, you may also agree to do another detailed 20-30 minute survey about your child's diet on two separate day (this is optional and you can decide today if you would like to do this). After completing the phone dietary survey(s), you will be randomly assigned to one of two groups using a process like the flip of a coin.



**Consent To Participate In A Research Study**

KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity

If you are assigned to **Group 1**, you will receive a monthly newsletter about boosting reading skills in your child. You will complete another set of assessments, including a one hour office visit, paper survey, phone dietary survey, weigh-in, and activity monitor, about 10 months from now. You will be contacted again after another year (about 2 years from now) for a shorter paper survey and weigh-in only.

If you are assigned to **Group 2**, you will also complete another set of assessments (including a one hour office visit, paper survey, phone dietary survey (or surveys if you decide to complete a phone surveys about your preschooler's diet), weigh-in, and activity monitor) in about 10 months. You will be contacted again after another year (about 2 years from now) for a shorter paper survey and weigh-in only. In addition, as part of **Group 2**, you would be asked to do the following:

1. receive a family kit in the mail once a month designed to help you prevent your child's chance of becoming overweight; the kit includes information and activities about healthy eating, physical activity, and parenting strategies. The kit's activities will take about an hour to complete each month. We encourage healthy behaviors. However, we will discourage the use of dietary supplements such as pills, herbal preparations, or other supplements unless prescribed by your doctor. There is very little information available on the safety and effectiveness of dietary supplements, and, in some cases, they can be dangerous;
2. participate in one 90 minute group classes emphasizing physical activity, healthy eating, and parenting strategies, and;
3. receive eight phone calls from a wellness coach during the study period to talk about how your family might incorporate the parenting skills and lifestyle changes that are part of the KAN-DO program. These phone calls, each about 20 minutes, will be audio recorded for quality assurance. Digital files of these recordings are saved on a password protected external hard drive, used only by counseling staff, and will be destroyed 6 years after the study has ended.

**Please initial one of the following statements:**

\_\_\_\_\_ I agree to take part in the phone surveys regarding my preschooler's diet (two phone surveys in the next few weeks, and another two phone surveys in about 9 months)

\_\_\_\_\_ I do not agree to take part in the phone surveys regarding my preschooler's diet.

**Benefits of participation**

Expected benefits to Group 1 participants may include increased bonding between the mothers and preschoolers due to the reading intervention. Expected benefits to Group 2 participants may include increased health and well-being, achieving and maintaining a healthy weight in the children and weight loss for the mothers, and an increase in physical activity and improved nutrition and dietary habits. The indirect benefit of the study is a better general understanding of successful interventions to increase weight loss and healthy weight-related behaviors in mothers and their children.





## DUKE UNIVERSITY HEALTH SYSTEM

### Consent To Participate In A Research Study

KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity

#### Risks or discomforts

When promoting increased physical activity, there is a small risk of injury or other adverse (bad) events. We have taken precautions to minimize these risks, however, there may be unforeseen problems that we have not anticipated. In case of injury during physical activity that is directly related to this study, please inform us immediately by calling the Duke study coordinator at 1-866-681-0860 or the UNCG study coordinator at 1-866-99-KAN-DO and describing the event, and what actions you have taken as a result (for instance, if you called a doctor).

Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. Further information concerning this or your rights as a research subject may be obtained from the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111. For Triad participants, contact the UNCG Office of Research Compliance at (336) 256-1482.

#### Remuneration and/or expense reimbursements

As part of this study, if you are assigned to Group 2, you will be asked to participate in one group classes about healthy habits in the home. You will not be charged fees for these activities and food will be provided. In addition, the free kits mailed to families in Group 2 include information and activities for adults and children. Families may receive prizes for completing activities in the family kits.

All women, regardless of group assignment, will receive a total of \$100 for completing all of the assessments (\$30 for the first set, \$30 for the second and \$40 for the third). Free parking is available whenever visits to the study site are required. Mileage reimbursement is available to families living more than 20 miles away at the current federal mileage reimbursement rate.

If you agree to take part in the optional surveys about your preschooler's diet, you will be paid an additional \$10 for the first set of assessments, and \$10 for the second set of assessments.

#### Additional costs to participate

Transportation to and from study activities will be the responsibility of the participant. The sponsor of the study, the National Institutes of Health, is providing the newsletter, classes, mailed materials and wellness coach consultations to women free of charge.

#### Participation

You and your child may choose not to be in the study, or, if you and your child agree to be in the study, you or your child may withdraw from the study at any time. If you withdraw from the study, no new data about you or your child will be collected for study purposes unless the data concern an adverse event (a bad effect) related to the study. If such an adverse event occurs, we may need to review your or



## DUKE UNIVERSITY HEALTH SYSTEM

### Consent To Participate In A Research Study

KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity

your child's medical record. All data that have already been collected for study purposes, and any new information about an adverse event related to the study, will be sent to the study sponsor.

Your decision not to participate or to withdraw yourself or your child from the study will not involve any penalty or loss of benefits to which you are entitled, and will not affect your access to health care at Duke or anywhere else. If you do decide to withdraw yourself or your child, we ask that you contact Dr. Østbye in writing and let him know that you are withdrawing from the study. His mailing address is DUMC Box 2914, Durham, NC 27710.

### Confidentiality

As part of this study, you will be asked questions about your weight and weight history, your eating patterns and habits, and your level of physical activity, in surveys conducted by telephone and in-person. We will also weigh you and your child three times. Data stored electronically will be in files and computers protected by password access. Any hardcopy records will be kept in locked metal filing cabinets at the study sites.

Study records that identify you or your child will be kept confidential as required by law. Federal Privacy Regulations provide safeguards for privacy, security, and authorized access. Except when required by law, you or your child will not be identified by name, social security number, address, telephone number, or any other direct personal identifier in study records disclosed outside of Duke University Health System (DUHS) or The University of North Carolina – Greensboro (UNCG). For records disclosed outside of DUHS or UNCG, you and your child will be assigned a unique code number. The key to the code will be kept in a locked file in Dr. Østbye's office. If you are randomly selected for Group 2, audio-recordings of your phone calls with the wellness coach will be stored electronically on a password protected external hard drive.

If the researchers have reason to believe a child is being abused (or has been abused), study staff are required by North Carolina state law to file a report with the appropriate agencies. If the researcher has reason to believe you may be a harm to yourself or others, our study physician will contact you for appropriate follow-up. In addition, your records may be reviewed in order to meet federal or state regulations. Reviewers may include, for example, representatives from the National Institutes of Health, the Duke University Health System Institutional Review Board or the University of North Carolina-Greensboro Office of Research Compliance. If any of these groups review your research record, they may also need to review your or your child's research record.

The study results will be retained in your research record for six years after the study is completed. At that time, information identifying you or your child will be removed from such study results at DUHS or UNCG. This information may be further disclosed by the sponsor of this study, the National Institutes of Health. If disclosed by the sponsor, the information is no longer covered by the federal privacy regulations.

Protocol ID: Pro00007666

Continuing Review Before: 6/15/2010

Reference Date: 5/29/2009

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Subject Initials: \_\_\_\_\_



## DUKE UNIVERSITY HEALTH SYSTEM

### Consent To Participate In A Research Study

KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity

The study results will be retained in your child's research record for six years after the study is completed or until your child reaches the age of 21, whichever is longer. At that time either the research information not already in your child's medical record will be destroyed or information identifying your child will be removed from such study results at DUHS. Any research information in your child's medical record will be kept indefinitely.

Dr. Cheryl Lovelady and her staff from the Nutrition Department at UNCG will conduct two interviews regarding your food intake, one in the next two weeks, and another in approximately 10 months. UNCG will have access to some information about you (your name and telephone number) so that they can contact you. UNCG will be conducting the surveys on Duke's behalf and acting as agents of Duke, and therefore are held under the same confidentiality standards as Dr. Østbye's study team.

### Questions

Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. For questions about the study or research-related injury, contact Dr. Truls Østbye at (919) 661-0331 or Dr. Cheryl Lovelady at (336) 256-0310 during regular business hours.

For questions about your rights as a research participant, Triangle participants should contact the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111. Triad participants should contact Eric Allen in the UNC-Greensboro Office of Research Compliance at (336) 256-1482.

### STATEMENT OF CONSENT

"The purpose of this study, procedures to be followed, risks and benefits have been explained to me. I have been allowed to ask questions, and my questions have been answered to my satisfaction. I have been told that I may contact the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111 if I have questions about my rights as a research subject, to discuss problems, concerns, or suggestions related to the research, or to obtain information or offer input about the research. I have read this consent form and agree to be in this study, with the understanding that I may withdraw at any time. I have been told that I will be given a signed copy of this consent form."

\_\_\_\_\_  
Signature of Subject

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Person Obtaining Consent

\_\_\_\_\_  
Date

Protocol ID: Pro00007666  
Continuing Review Before: 6/15/2010  
Reference Date: 5/29/2009

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Subject Initials: \_\_\_\_\_

**APPENDIX C: UNIVERSITY OF NORTH CAROLINA –  
GREENSBORO CONSENT FORM**



**DUKE UNIVERSITY HEALTH SYSTEM**



THE UNIVERSITY of NORTH CAROLINA  
**GREENSBORO**

**PARTICIPANT CONSENT FORM – PAGE 1 of 5**

**KAN-DO study**

Truls Østbye, MD, MPH, PhD  
Cheryl Lovelady, PhD, RD, LDN, FADA  
DUMC IRB Registry number: 8609  
UNCG IRB Registry number: 078021

**Introduction**

The Duke University Medical Center (DUMC) and The University of North Carolina at Greensboro (UNCG) are conducting a research study about the importance of preventing children from becoming overweight. As a woman who recently delivered a baby and is the parent of a child between 2 and 5, you and your preschooler are eligible to participate in this study. This study is being sponsored by a grant from the National Institutes of Health (NIH). Portions of Dr. Østbye's, Dr. Lovelady's and the research team's salaries are being paid by this grant.

Research studies include only people who choose to take part. Please read this consent form carefully and take your time making your decision. As your study staff discusses this consent form with you, please ask him/her to explain any words or information that you do not clearly understand and answer any questions you may have. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

**Purpose of the Study**

The goal of the study is to determine whether the KAN-DO intervention can encourage healthy eating, increased physical activity, and healthy weights among participating women and their children.

**How the Study Works**

Women who recently had a baby in the Raleigh/Durham/Chapel Hill or Greensboro/Winston-Salem/High Point regions of North Carolina, and also have a child aged 2-5, are English speaking, and are age 18 or older will be eligible to participate. A total of 400 women and 400 children will be enrolled in the study. The study will take place over the course of about 2 years.

If you agree to be in the study, we will ask you to visit us at Duke (for the Triangle families) or UNCG (for the Triad families). We will have you sign the consent form and we will give you a copy for your records. At that visit, we will weigh and measure you and your child. We will measure your waist and hip circumference. You will be asked to complete a 30-minute paper and pencil survey about your family's health and parenting behaviors. When you and your toddler attend a one-hour session at either DUMC or UNCG, you will be fitted for an activity monitor that you will both wear for one week, and then return via pre-paid envelope or in person. After your visit, you will be called by The University of North Carolina – Greensboro for a detailed 20-30 minute survey about your diet on two separate days.





**DUKE UNIVERSITY HEALTH SYSTEM**



THE UNIVERSITY of NORTH CAROLINA  
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**PARTICIPANT CONSENT FORM – PAGE 2 of 5**

**KAN-DO study**

Truls Østbye, MD, MPH, PhD

Cheryl Lovelady, PhD, RD, LDN, FADA

DUMC IRB Registry number: 8609

UNCG IRB Registry number: 078021

within a two-week period. After completing that phone dietary survey, you will be randomly assigned to one of two groups using a process like the flip of a coin.

If you are assigned to **Group 1**, you will receive a monthly newsletter about boosting reading skills in your child. You will complete another set of assessments, including a one hour office visit, paper survey, phone dietary survey, weigh-in, and activity monitor, about 10 months from now. You will be contacted again after another year (about 2 years from now) for a shorter paper survey and weigh-in only.

If you are assigned to **Group 2**, you will also complete another set of assessments (including a one hour office visit, paper survey, phone dietary survey, weigh-in, and activity monitor) in about 10 months. You will be contacted again after another year (about 2 years from now) for a shorter paper survey and weigh-in only. In addition, as part of **Group 2**, you would be asked to do the following:

1. receive a family kit in the mail once a month designed to help you prevent your child's chance of becoming overweight; the kit includes information and activities about healthy eating, physical activity, and parenting strategies. The kit's activities will take about an hour to complete each month. We encourage healthy behaviors. However, we will discourage the use of dietary supplements such as pills, herbal preparations, or other supplements unless prescribed by your doctor. There is very little information available on the safety and effectiveness of dietary supplements, and, in some cases, they can be dangerous;
2. participate in two 90 minute group classes emphasizing physical activity, healthy eating, and parenting strategies, and;
3. receive eight phone calls from a wellness coach during the study period to talk about how your family might incorporate the parenting skills and lifestyle changes that are part of the KAN-DO program. These phone calls, each about 20 minutes, will be audio recorded for quality assurance.

**Benefits of participation**

Expected benefits to Group 1 participants may include increased bonding between the mothers and preschoolers due to the reading intervention. Expected benefits to Group 2 participants may include increased health and well-being, achieving and maintaining a healthy weight in the children and weight loss for the mothers, and an increase in physical activity and improved nutrition and dietary habits. The indirect benefit of the study is a better general understanding of successful interventions to increase weight loss and healthy weight-related behaviors in mothers and their children.

**Risks or discomforts**

When promoting increased physical activity, there is a small risk of injury or other adverse (bad) events. We have taken precautions to minimize these risks, however, there may be unforeseen problems that we



**DUKE UNIVERSITY HEALTH SYSTEM**



THE UNIVERSITY of NORTH CAROLINA  
**GREENSBORO**

**PARTICIPANT CONSENT FORM – PAGE 3 of 5**

**KAN-DO study**

Truls Østbye, MD, MPH, PhD

Cheryl Lovelady, PhD, RD, LDN, FADA

DUMC IRB Registry number: 8609

UNCG IRB Registry number: 078021

have not anticipated. In case of injury during physical activity that is directly related to this study, please inform us immediately by calling the Duke study coordinator at 1-866-681-0860 or the UNCG study coordinator at 1-866-99-KAN-DO and describing the event, and what actions you have taken as a result (for instance, if you called a doctor).

Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. Further information concerning this or your rights as a research subject may be obtained from the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111. For Triad participants, contact the UNCG Office of Research Compliance at (336) 256-1482.

**Remuneration and/or expense reimbursements**

As part of this study, if you are assigned to Group 2, you will be asked to participate in two educational activities (group classes) about healthy eating. You will not be charged fees for these activities and food will be provided. In addition, the free kits mailed to families in Group 2 include information and activities for adults and children. Families may receive prizes for completing activities in the family kits.

All women, regardless of group assignment, will receive a total of \$100 for completing all of the assessments (\$30 for the first set, \$30 for the second and \$40 for the third). Free parking is available whenever visits to the study site are required.

**Additional costs to participate**

Transportation to and from study activities will be the responsibility of the participant. The sponsor of the study, the National Institutes of Health, is providing the newsletter, classes, mailed materials and wellness coach consultations to women free of charge.

**Participation**

You may choose not to be in the study, or, if you agree to be in the study, you may withdraw from the study at any time. If you withdraw from the study, no new data about you will be collected for study purposes unless the data concern an adverse event (a bad effect) related to the study. If such an adverse event occurs, we may need to review your or your toddler's medical record. All data that have already been collected for study purposes, and any new information about an adverse event related to the study, will be sent to the study sponsor.



**DUKE UNIVERSITY HEALTH SYSTEM**



THE UNIVERSITY of NORTH CAROLINA  
**GREENSBORO**

**PARTICIPANT CONSENT FORM – PAGE 4 of 5**

**KAN-DO study**

Truls Østbye, MD, MPH, PhD

Cheryl Lovelady, PhD, RD, LDN, FADA

DUMC IRB Registry number: 8609

UNCG IRB Registry number: 078021

Your decision not to participate or to withdraw from the study will not involve any penalty or loss of benefits to which you are entitled, and will not affect your access to health care at Duke or anywhere else. If you do decide to withdraw, we ask that you contact Dr. Østbye in writing and let him know that you are withdrawing from the study. His mailing address is DUMC Box 2914, Durham, NC 27710.

**Confidentiality**

As part of this study, you will be asked questions about your weight and weight history, your eating patterns and habits, and your level of physical activity, in surveys conducted by telephone and in-person. We will also weigh you and your child three times. Data stored electronically will be in files and computers protected by password access. Any hardcopy records will be kept in locked metal filing cabinets at the study sites.

There is a small risk that confidentiality could be breached. Every effort will be made to maintain confidentiality. Study records that identify you will be kept confidential as required by law. Federal Privacy Regulations provide safeguards for privacy, security, and authorized access. Except when required by law, you will not be identified by name, social security number, address, telephone number, or any other direct personal identifier in study records disclosed outside of Duke University Health System (DUHS) or The University of North Carolina – Greensboro (UNCG). For records disclosed outside of DUHS or UNCG, you will be assigned a unique code number. The key to the code will be kept in a locked file in Dr. Østbye's office.

In addition, your records may be reviewed in order to meet federal or state regulations. Reviewers may include, for example, representatives from the National Institutes of Health, the Duke University Health System Institutional Review Board or The University of North Carolina-Greensboro Office of Research Compliance. If any of these groups review your research record, they may also need to review your or your toddler's research record.

The study results will be retained in your research record for six years once recruitment and the study are completed (Winter 2017). At that time, information identifying you will be removed from such study results at DUHS or UNCG. This information may be further disclosed by the sponsor of this study, the National Institutes of Health. If disclosed by the sponsor, the information is no longer covered by the federal privacy regulations

Dr. Cheryl Lovelady and her staff from the Nutrition Department at UNCG will conduct two interviews regarding your food intake, one in the next two weeks, and another in approximately 10 months. UNCG will have access to some information about you (your name and telephone number) so that they can





**DUKE UNIVERSITY HEALTH SYSTEM**



THE UNIVERSITY of NORTH CAROLINA  
**GREENSBORO**

**PARTICIPANT CONSENT FORM – PAGE 5 of 5**

**KAN-DO study**

Truls Østbye, MD, MPH, PhD

Cheryl Lovelady, PhD, RD, LDN, FADA

DUMC IRB Registry number: 8609

UNCG IRB Registry number: 078021

contact you. UNCG will be conducting the surveys on Duke's behalf and acting as agents of Duke, and therefore are held under the same confidentiality standards as Dr. Østbye's study team.

**Questions**

If you have any questions, you may contact Dr. Truls Østbye at (919) 661-0331 or Dr. Cheryl Lovelady at (336) 256-0310. If you live in the Triangle, please contact the study coordinator, Rebecca Brouwer, at (919) 681-0858/(866)-681-0860. If you live in the Triad, please contact the study coordinator, Debbie West at (336) 334-9842 or 1-866-99-KANDO.

For questions about your rights as a research participant, Triangle participants should contact the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111. Triad participants should contact Eric Allen in The University of North Carolina at Greensboro Office of Research Compliance at (336) 256-1482.

**Authorization**

"The purpose of this study, procedures to be followed, risks and benefits have been explained to me. I have been allowed to ask questions, and my questions have been answered to my satisfaction. I have been told whom to contact if I have additional questions. I have read this consent form and agree for me and my child to be in this study, with the understanding that either of us may withdraw at any time. I have been told that I will be given a signed copy of this consent form."

By signing this form, you are agreeing to participate in the project described to you by the research staff.

Signature of subject: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of person obtaining consent: \_\_\_\_\_ Date: \_\_\_\_\_